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NOTA lepidopterologica

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NOTA LEPIDOPTEROLOGICA

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A contribution to the knowledge of the butterfly fauna of East Jordan

G. C. Bozano

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Inspired by the superb work by T. B. Larsen and I. Nakamura (1983), *The Butterflies of East Jordan*, I twice visited that country in 1989 – from March 20th-24th and again from April 24th-29th. I used this work to plan the itinerary, and the present note will make continuous reference to it, both for distribution data and nomenclature.

The timing was very appropriate : in March I found most of the spring species, while in April many summer species were already on the wing. Of the 82 species known from the area, I recorded 52. Some of the species were previously known only from single specimens e.g. *Iolana alfierii* Wiltshire and *Precis orithya here* Lang, or were just suspected to occur (*Anthocharis cardamines* L.). Others such as *Papilio alexanor* Esper had not been seen for many years.

Most significant records

Papilio alexanor maccabaeus Staudinger : One worn female collected at Wadi Kufrinja in March seems to be the first Jordanian record for more than 30 years. One week later D. Baiocchi found many worn specimens in Israel (pers. comm.). The flight period in the area is likely to be the beginning of March.

Euchloe aegyptiaca Verity : Unexpectedly common west of Petra along the road that descends to Wadi Araba. In the Azraq National Park, Eastern Desert, I found a much larger form, but still with well defined stripes on the hindwing underside.

Zegris eupheme Esper : Subspecies *uarda* Hemming is very common in the north. In the Southern Desert I collected ssp. *larseni* Pittaway with the undersides of the forewing apex and hindwing almost completely yellow. The specimens I found around Petra appear to be closer to the Southern Desert form than to *uarda.*

Anthocharis cardamines phoenissa von Kalchberg : One female collected at Wadi Kufrinja in March is the first available record from Jordan.

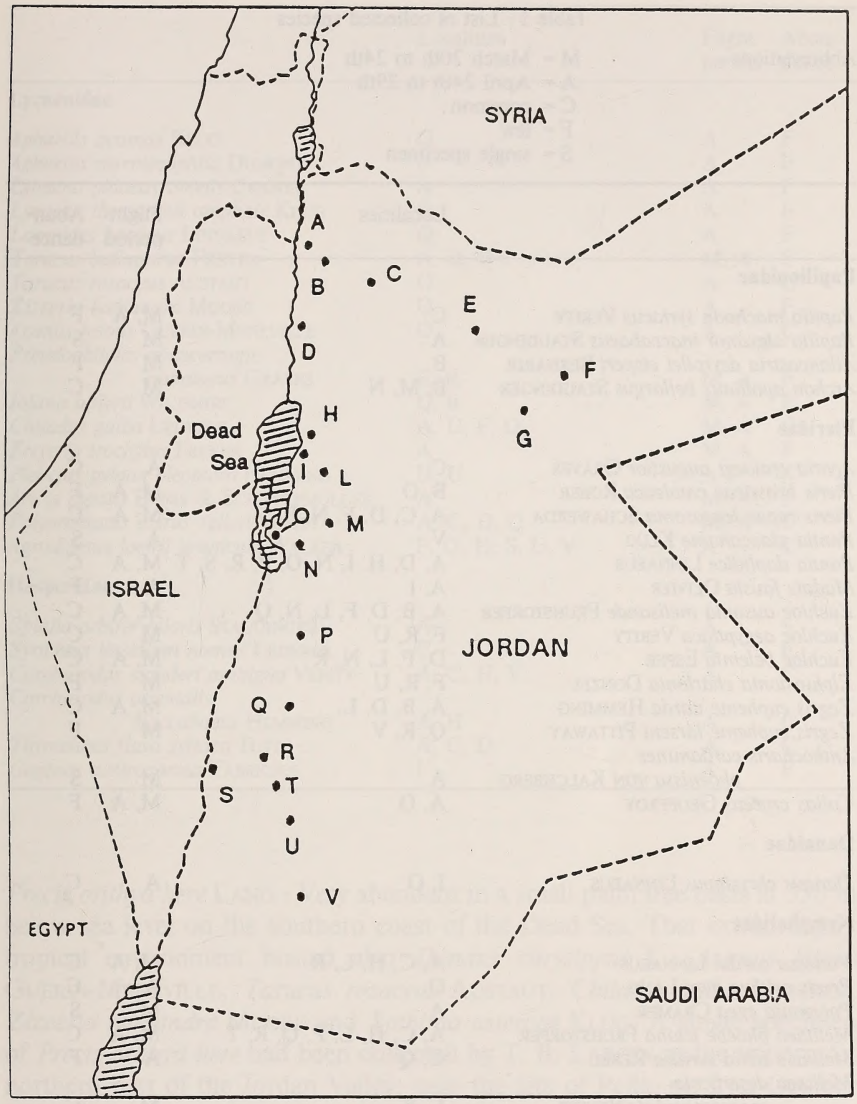

Fig. 1. List of the localities.

From North to South :

A) Wadi Kufrinja 100/300 m (Ajlun)
B) Sakib 800 m (Ajlun)
C) Jarash 800 m
D) 20 km West of El Salt - 100 m
E) Qasr el Hallabat 400 m (Eastern Desert)
F) El Azraq 400 m (Eastern Desert)
G) Qasr el Amra 400 m (Eastern Desert)
H) Main 400 m (Madaba)
I) Callirhoe - 150 m (Madaba)
L) Wadi el Mujib 400 m (Madaba)
M) Rabba 900 m (Karak)
N) Wadi el Karak 700 m (Karak)
O) Al Mazra'a - 350 m (Dead Sea)
P) Tafila 1000 m
Q) 30 km South of Tafila 1250 m
R) Petra 700/900 m
S) Wadi Araba 50/300 m (Petra)
T) Jabal Harun 1600 m (Petra)
U) Ras en Naqb 1200 m (Southern Desert)
V) Wadi Ram 800 m (Southern Desert)

Table 1 : List of collected species

Abbreviations :
M = March 20th to 24th
A = April 24th to 29th
C = common
F = few
S = single specimen

	Localities	Flight period	Abundance
Papilionidae			
Papilio machaon syriacus VERITY	C	M, A	F
Papilio alexanor maccabaeus STAUDINGER	A	M	S
Allancastria deyrollei eisneri BERNARDI	B	M	F
Archon apollinus bellargus STAUDINGER	B, M, N	M	C
Pieridae			
Aporia crataegi augustior GRAVES	C	A	C
Pieris brassicae catoleuca ROBER	B, O	M, A	F
Pieris rapae leucosoma SCHAWERDA	A, C, D, F, N, R	M, A	C
Pontia glauconome KLUG	V	A	S
Pontia daplidice LINNAEUS	A, D, H, I, N, O, P, R, S, T	M, A	C
Madais fausta OLIVIER	A, I	A	F
Euchloe ausonia melisande FRUHSTORFER	A, B, D, F, L, N, Q	M, A	C
Euchloe aegyptiaca VERITY	F, R, U	M	C
Euchloe belemia ESPER	D, F, L, N, R	M, A	C
Elphinstonia charlonia DONZEL	F, R, U	M	F
Zegris eupheme uarda HEMMING	A, B, D, L	M, A	C
Zegris eupheme larseni PITTAWAY	Q, R, V	M	F
Anthocharis cardamines phoenissa VON KALCHBERG	A	M	S
Colias croceus GEOFFROY	A, O	M, A	F
Danaidae			
Danaus chrysippus LINNAEUS	I, O	A	C
Nymphalidae			
Vanessa cardui LINNAEUS	A, C, H, L, R	M, A	C
Precis orithya here LANG	O	A	C
Polygonia egea CRAMER	A	M	S
Melitaea phoebe telona FRUHSTORFER	A, C, H, L, P, Q, R, T	M, A	C
Melitaea trivia syriaca REBEL	C, Q	A	F
Melitaea deserticola macromaculata BELTER	L, R	M	C
Satyridae			
Melanargia titea palestinensis STAUDINGER	A, C, H, P	A	C
Pseudochazara telephassa GEYER	H	A	C
Maniola telmessia ZELLER	A, C	A	C
Ypthima asterope KLUG	A, D, H, O	M, A	C
Lasiommata megera emilyssa VERITY	D, R	M	F

	Localities	Flight period	Abundance
Lycaenidae			
Apharitis acamas KLUG	G	A	F
Apharitis myrmecophila DUMONT	F	A	F
Lycaena phlaeas timeus CRAMER	A	A	F
Lycaena thersamon omphale KLUG	C	A	F
Lampides boeticus LINNAEUS	Q	A	F
Tarucus balkanicus FREYER	A, D, O	M, A	C
Tarucus rosaceus AUSTAUT	O	A	C
Zizeeria karsandra MOORE	O	A	F
Azanus jesous GUERIN-MENEVILLE	O	A	C
Pseudophilotes abencerragus nabataeus GRAVES	E, R	M, A	F
Iolana alfierii WILTSHIRE	Q, R	M, A	F
Chilades galba LEDERER	A, D, F, O	M, A	C
Freyeria trochylus FREYER	A	M, A	F
Plebejus pylaon cleopatra HEMMING	H, U	A	F
Aricia agestis DENIS & SCHIFFERMULLER	A	M, A	F
Polyommatus icarus zelleri VERITY	A, C, D, Q	M, A	C
Agrodiaetus loewii uranicola WALKER	F, G, H, S, U, V	A	C
Hesperidae			
Spialia orbifer hilaris STAUDINGER	A	A	S
Syrichtus tessellum nomas LEDERER	C	A	F
Carcharodus stauderi ambigua VERITY	A, C, H, V	A	C
Carcharodus orientalis maccabaeus HEMMING	A, H	A	C
Thymelicus flava syriaca TUTT	A, C, D	A	C
Gegenes nostrodamus FABRICIUS	I	A	F

Precis orithya here LANG : Very abundant in a small palm tree oasis at 350 m below sea level on the southern coast of the Dead Sea. That extraordinary tropical environment hosted also *Danaus chrysippus* L., *Azanus jesous* GUERIN-MENEVILLE, *Tarucus rosaceus* AUSTAUT, *Chilades galba* LEDERER, *Zizeeria karsandra* MOORE and *Ypthima asterope* KLUG. A single specimen of *Precis orithya here* had been collected by T. B. LARSEN in the uppermost northern part of the Jordan Valley, near the site of Pella, on 21st October 1983.

Apharitis myrmecophila DUMONT : One of the most localized and rare of Jordan's butterflies. I found five specimens at Qasr el Azraq, Eastern Desert.

Iolana alfierii WILTSHIRE : In March I collected one male at Petra flying around the only *Colutea* seen during two days search. In April I discovered a large population 30 km south of Tafila on a slope with many *Colutea* bushes.

Agrodiaetus loewii uranicola WALKER : Found also in the Southern Desert as predicted by LARSEN & NAKAMURA.

Syrichtus tessellum nomas LEDERER : Two males collected at Jarash. According to LARSEN & NAKAMURA less than ten specimens were known from Jordan.

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←

Plate I :

Left column

Papilio alexanor ♀ Wadi Kufrinja 300 m 21.III.1989
Euchloe aegyptiaca ♂ Petra 700 m 23.III.1989
Euchloe aegyptiaca ♂ El Azraq 400 m 24.III.1989
Iolana alfierii ♂ 30 km South of Tafila 1250 m 27.IV.1989
Iolana alfierii ♀ 30 km South of Tafila 1250 m 27.IV.1989

Right column

Anthocharis cardamines ♀ Wadi Kufrinja 300 m 21.III.1989
Precis orithya ♂ Al Mazra'a - 350 m 29.IV.1989
Zegris eupheme uarda ♂ underside Wadi Kufrinja 300 m 21.III.1989
Zegris eupheme larseni ? ♂ underside Petra 900 m 23.III.1989
Zegris eupheme larseni ♂ underside Wadi Ram 800 m 22.III.1989

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Further data on *Parnassius apollo* LINNÉ, 1758 in the Peloponnesos (Lepidoptera, Papilionidae) (*)

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Summary

A population of *Parnassius apollo* L. from the Peloponnesos, corresponding to ssp. *atrides* DER POORTEN & DILS, 1986, is reported. It flies on Mt. Erímanthos at 2000-2100 m. Some data on its habitat are given.

During the last eighteen years, one of the authors (A. CASALE) intensively explored the greatest part of the main massifs of Greece for entomological and biospeleological purposes. The highest mountains of the Peloponnesos were visited many times and at different seasons : Mt. Taygetos 2407 m, Mt. Kelmos or Aroania 2341 m, Mt. Kyllini 2376 m, Mt. Maenalo 1980 m, Mt. Erímanthos 2224 m. On the latter, which is the most difficult to reach, a small population of *Parnassius apollo* LINNÉ, 1758 was discovered during a collecting trip with Prof. M. OLMI (University of Viterbo, Italy) in July 1983.

Parnassius apollo L. is rather widely distributed and locally common on the mountains of northern and central Greece and many subspecies have been named. However, the systematic status and validity of these subspecies/races have not yet been definitively clarified and merit more careful investigation (see e.g. RACHELI *et al.*, 1983).

The occurrence of *Parnassius apollo* L. in the Peloponnesos (S. Greece) was reported for the first time by PAGENSTECHER(1913), who described *Parnassius apollo peloponnesiacus* on the basis of three males and one female collected by NEUSCHILD "bei Patras in Peloponnes". Though the massifs of the Peloponnesos are currently visited by many lepidopterists to collect rare or endemic species (such as *Agrodiaetus aroanensis* BROWN, 1976), the occurrence of this remarkable and well known butterfly in the southern

(*) Research supported by grants from M.P.I. (40%).

Figs. 1-4. *Parnassius apollo* L., from Greece and Turkey. 1 : ssp. *graecus* ZIEGLER, 1901, GR-Pindos, Katara Pass m 1600, 23.VII.1982, A. FLORIANI leg. ; 2 : idem, GR-Mt. Ghiona m 1800, 8.VII.1988, A. CASALE leg. ; 3 : ssp. *paphlagonicus* BRIK & EISNER, 1938, TR-Bartin, Ahmetusta Pass m 1600, 22.VII.1987, P. F. CAVAZZUTI leg. ; 4 : ssp. *atrides* DER POORTEN & DILS, 1986, GR-Peloponnesos, Mt. Erímanthos m 2000, 17.VII.1983, A. CASALE & M. OLMI leg. (Phot. A. CASALE).

peninsula of Greece had never been confirmed, so that it was considered doubtful or wrong by most recent authors (BRYK, 1935 ; EISNER, 1962). On the latest distribution maps the southern limit of *Parnassius apollo* L. is therefore marked to the latitude of central Greece (CAPDEVILLE, 1978-80).

Finally, in July 1983 a population was rediscovered by A. CASALE and M. OLMI on Mt. Erímanthos. Three years later, DER POORTEN and DILS (1986) described ssp. *atrides* on the basis of a large series of specimens collected somewhere on the Peninsula in July 1985. These authors do not give any chorological data for their find, "because of the commercial popularity of *Parnassius apollo*... as an ecological measure".

We agree with their precaution, particulary because ssp. *atrides* comes from a more accessible locality at low altitude (from 1300 to 1800 m). We think the same prudence is unnecessary for the population living on Mt. Erímanthos at high altitude, in a zone very difficult to find and to reach.

The population of Mt. Erímanthos

Erímanthos is a massif of Mesozoic limestone with the highest peak (Mt. Olénos) at 2224 m. The vegetation above 1000 m up to 1600-1700 m is formed by rather large forests of *Pinus nigra* ARNOLD and *Abies cephalonica* LOUDON.

Above 1700-1800 m, there are large high altitude prairies and grasslands. Near the top, a superficial karsism is well developed ; no deep caves are known.

The few specimens of *Parnassius apollo* L. were observed flying over the stony, steep sides of the mountain below the summit, at 2000-2100 m. This zone can be reached after a march of several hours. At the time of the visit by A. CASALE and M. OLMI (17 July 1983), only more or less damaged females were present, of which only two were collected (fig. 4) ; during the same period, the specimens in C. Greece were still relatively fresh.

The specimens from Erímanthos correspond perfectly to ssp. *atrides* DER POORTEN and DILS, 1986, which exhibits a number of characters different from the other Greek subspecies. These authors examined a pair from the type series of ssp. *peloponnesiacus* PAGENSTECHER, 1913, which they found to correspond well with ssp. *graecus* ZIEGLER, 1901 but differing from *atrides* : it could come from a northern locality and was incorrectly labelled (DER POORTEN & DILS, 1986).

Discussion

The rediscovery of *Parnassius apollo* L. in the Peloponnesus is very interesting from the biogeographical point of view. In fact, it demonstrates a deep penetration of the species to the S. Balkans during the last Ice Age, exactly as in the Iberian, Italian and Anatolian Peninsulas. In all these regions *Parnassius apollo* L. has survived to the present ipsothermic age in more or less small, isolated, orophilous populations. On the other hand, it will also be interesting to ascertain whether other populations are still present in other massifs of the Peloponnesus, and to determine their morphological distance from that of Mt. Erímanthos.

Acknowledgements

We would like to express our gratitude to Prof. E. BALLETTO (University of Turin), Dr. V. CAMERON-CURRY (Turin), Prof. M. OLMI (University of Viterbo) and Prof. T. RACHELI (University of Rome) for their kind assistance in this work.

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Corrigenda to Nota Lep. 12 (4) : p. 355 (WILTSHIRE)

l. 15 : for 15.VI.1936 read : – 15.XI.1936.

l. 17 : after "generation" *delete* "," !

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Psychidenbeobachtungen in Westrumänien – Teil 1 (Lepidoptera, Psychidae)

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Zusammenfassung

Beobachtungen von 1983 und 1986 zur Psychidenfauna des Banats und Teilen Siebenbürgens werden mitgeteilt. Die Autoren konnten insgesamt 26 Arten auffinden. Aus der Literatur sind für das Gebiet weitere 9 Arten bekannt, deren Determination beziehungsweise deren Vorkommen zum Teil fraglich erscheinen. Deshalb erweisen sich moderne Aufsammlungen und Untersuchungen zur rumänischen Psychidenfauna als notwendig.

Summary

Twenty-six species of Psychidae are reported from Banat and parts of Siebenbürgen (Rumania). A further 9 species are recorded in the literature, but their identity and/or occurrence requires confirmation. Further studies of the Rumanian Psychid fauna are therefore necessary.

Einleitung

Vom 30.4. bis zum 9.5.1986 sammelten die Autoren auf einer gemeinsamen Exkursion in Westrumänien speziell Psychiden. Die Ergebnisse sollen hier dargestellt werden, ergänzt durch einige Beobachtungen von M. WEIDLICH Ende Mai 1983. Das Exkursionsgebiet umfaßt Teile des Banats (Aufsammlungen am Eisener Tor, Orşova, Herkulesbad, Armeniş, Caransebeş, Poarta du Fier, Lugoj, Arad, Lipova, Ilteu, Zam, Toc, Nicolae Balcescu) sowie Südwest-Siebenbürgens (Funde bei Haţeg, Petroşani, Jiul-Felsschlucht, Gurasada).

Geologie, Klima, Vegetation

Die Südwestkarpaten sind das landschaftsbestimmende Element dieser Region. Die Herausbildung dieses Gebirges erfolgte im Tertiär, vornehmlich im Jungtertiär. Hauptsächlich sind paläozoische Paragneise und Tonschiefer anstehend, z.B. am Eisernen Tor, Orşova und Petroşani. Daneben bestim-

men Intrusiva wie Granit sowie Sedimente wie die Malm- und unterkretazischen Korallenkalke bei Herkulesbad (bis 1000 m mächtig) das Bild. Letztere bedingen eine bemerkenswerte Flora und Fauna, die sich deutlich von denen der übrigen Karpaten unterscheidet. Aufgrund der vielgestaltigen geologischen Grundstrukturen herrschen im Gebiet vielfältige Klimata, besonders standortabhängige Mikroklimata.

Das Untersuchungsgebiet zeichnet sich hauptsächlich durch subkontinentales Klima aus, das teilweise im Bereich des Eisernen Tores und Orşovas Anklänge zur kontinentalen Sommertrockenheit zeigt. Ein für Gebirgsgegenden besonders mildes Klima gibt es bei Herkulesbad, während die Umgebung Petroşanis ein typisch kontinentales Klima aufweist.

Als Vegetationszonen herrschen am Eisernen Tor Waldsteppe, bei Orşova und Haţeg kontinentale Laubmischwälder der planaren, collinen und submontanen Stufe (mit Balkaneiche – *Quercus frainetto* – und Traubeneiche – *Quercus petraea*) vor, die sich in der Agrarlandschaft des nördlichen Banats nur noch in sehr wenigen Inseln finden. Herkulesbad und Petroşani gehören der zentraleuropäischen montanen Eichenwaldzone (mit Rotbuche – *Fagus sylvatica* – und Traubeneiche – *Quercus petraea*) an.

Nachfolgend werden vier Hauptsammelgebiete kurz charakterisiert:

1. Eisernes Tor (Hänge am Donaunordufer):

Xerotherme Felsflurhänge mit Gebüschvegetation, in Erosionskerben stehen Laubwälder. Gekennzeichnet durch ein sehr mildes Lokalklima mit heißtrockenen Sommern und folgenden Florenelementen: *Quercus pubescens* (Flaumeiche), *Corylus colurna* (Türkische Haselnuß), *Juglans regia* (Walnuß), *Acanthus longifolius* (Akanthusblatt), *Echinops banaticus* (Banater Kugeldistel) und *Alyssum murale* (Mauer-Steinkraut). Die Tierwelt repräsentiert sich u.a. mit *Testudo hermanni* (Griechische Landschildkröte), *Libelluides ottomanus* Germ. (Neuroptera), *Anthaxia salices* F., *A. bicolor* Fald., *Deilus fugax* Ol., *Morimus funereus* Muls. (Coleoptera), *Parnassius mnemosyne* L., *Iphiclides podalirius* L., *Libythea celtis* Laich., *Arctia villica* L., *Saturnia pyri* Schiff. und *Eupithecia graphata* ssp. *spröngertsi* (Lepidoptera).

2. Herkulesbad – Domogledgebiet:

Ältestes Naturschutzgebiet Rumäniens, bestehend seit 1932. Gebirgslandschaft, die infolge geringer Gefährdung durch kontinentale Winterfröste reich an submediterranen und thermophilen Elementen ist: *Syringa vulgaris* (Gemeiner Flieder), *Carpinus orientalis* (Orientalische Hainbuche), *Pinus nigra banatica* (Banater Schwarzkiefer), *Dianthus gigantheus banaticus* (Banater Nelke) und die endemische *Hieracium herculis* (Herkulesbader Habichtskraut).

3. Gurasada :

Frischkräuterrassen, südexponiert an einer Straßenböschung inmitten der Agrarlandschaft mit *Salvia* sp. (Salbei), *Prunus spinosa* (Schlehe in Krüppelformen) und *Quercus petraea* (Traubeneichenbüsche).

4. Jiul – Felstal südlich Petroşani :

Kühle Gebirgsschlucht im collinen und submontanen Bereich mit Buchen und Eichendominanz. Ab 700 m eingestreut *Abies alba* (Tanne) und *Picea abies* (Fichte).

Frühere und gegenwärtige Forschungen zur Schmetterlingsfauna

Die Umgebung von Herkulesbad und Orşova sowie teilweise auch des Eisernen Tors zählt heute zu den lepidopterologisch am besten durchforschten Gebieten Südosteuropas. Die ersten Aufsammlungen erfolgten 1793 durch den Deutschen v. HOFFMANNSEGG, der in den Heilbädern von Herkulesbad und Mehadia weilte. Die Heilbäder wurden bereits von den Römern unter Kaiser Trajan um 100 unserer Zeit erbaut und zählen somit zu den ältesten Südosteuropas. Eine umfassende Studie zur Schmetterlingsfauna dieser Region veröffentlichte REBEL (1911), der sich neben den Untersuchungen von v. HOFFMANSEGG vor allen auf die von KINDERMANN, HABERHAUER, MANN, v. FRIVALDSKY, AIGNER-ABAFI, FISCHER und v. ROTHSCHILD stützte. Im siebenbürgischen Teil waren es die Bemühungen von CZEKELIUS, die eine Faunenaufstellung ermöglichten (CZEKELIUS 1897, 1917) und von DIOSZEGHY fortgeführt wurden (DIOSZEGHY 1929/30, 1934). Die Forschungen wurden dann in der zweiten Hälfte diese Jahrhunderts vor allem durch rumänische Entomologen fortgesetzt. Stellvertretend sollen KÖNIG und POPESCU-GORJ genannt werden. Die Aufsammlungen zur Psychidenfauna des Untersuchungsgebietes fanden jedoch nur sporadisch und ohne besondere Intensität statt und sind nur mit wenigen Namen verbunden : MANN, v. FRIVALDSKY, HEDEMANN, PAVEL, REBEL, HERING, CZEKELIUS, OSTROGOVICH, CAPUSE und KÖNIG. Als Ergebnis liegen Beobachtungen von 26 Arten vor, deren Determination zum Teil sehr unsicher ist. Auch heute ist die Zahl der rumänischen Entomologen sehr gering, was sich auch in der Anzahl der wissenschaftlichen Publikationen wiederspiegelt (KÖNIG 1981). Deshalb erscheint es den Autoren angebracht, die Psychidenliteratur des Gebietes kritisch auszuwerten und eigene Beobachtungen mitzuteilen. Insgesamt werden mit den oben genannten Einschränkungen 35 Arten mitgeteilt.

Weiterhin soll dieser Beitrag Anregungen für die noch gering durchforschten Gebiete des Retezat-Gebirges, der Umgebung Petroşanis, der malerischen Jiul-Felsschlucht und der Xerothermgebiete am Nordufer der Donau im Bereich des Eisernen Tores geben.

Systematisch-faunistischer Teil

Die nachfolgend besprochenen Arten sind durch Belegmaterial in den Sammlungen der Verfasser nachprüfbar. Die Angaben, falls nicht anders vermerkt, beziehen sich auf 1986 und die Beobachtungszeiten erfolgen ausnahmslos in südosteuropäischer Sommerzeit. Den Untersuchungen zur Genitalmorphologie und Flügelschuppenklassifizierung wurde SAUTER (1956) zugrunde gelegt.

1. *Narycia monilifera* GEOFF.

Am 8.5. nördlich von Haţeg in einem Eichenwald 2 besetzte und 2 leere Säcke.

2. *Dahlica triquetrella* HB.

Verbreitet, zumeist in Anzahl an Felsen angesponnen: Eisernes Tor, Herkulesbad, Armeniş, 1 km W Petroşani, Jiul-Felstal, 6 km E Petroşani (500 m), Haţeg-Nord.

3. *Dahlica lichenella* L.

An einem magmatischen Felsblock 1 km W Petroşani 6 leere Säcke, davon 2 mit weiblicher Puppenhülle (5.5.).

4. *Dahlica* cf. *wagneri* GOZM.

In der Jiul-Felsschlucht südlich von Petroşani, 8 km E Petroşani (600 m) und 17 km E Petroşani (1000 m) wurden Populationen gefunden, deren Männchen denen von D. *wagneri* (locus typicus Mt. Tibles, Nordrumänien-Untersuchung der Paratypen durch R. HERRMANN) ähneln. Hinsichtlich der Schuppenbreite (Typ 2) besteht Übereinstimmung und bezüglich der Genitalindices Ähnlichkeit:

D. *wagneri* (Paratypen)	: 1,28-1,46 ; n = 2
D. cf. *wagneri*	: 1,23-1,54 ; n = 4

Eine eindeutige Determination unserer Tiere ist nur durch direkte Vergleiche mit einer *wagneri*-Serie vom locus typicus möglich. Die Entfernung beider Fundplätze beträgt 240 km (Luftlinie über das Karpatenbecken) bzw. über 400 km entlang der Karpatengebirgszüge.

Material: 9 Männchen 6.5.-10.5. Jiul-Felschlucht S Petroşani
3 Männchen 9.5.-10.5 17 km E Petroşani (1000 m)
1 Männchen 10.5. 8 km E Petroşani (800 m)
7 Weibchen 6.5.-10.5. Jiul-Felsschlucht S Petroşani (500 m) ca. 260 leere Säcke.

5. *Postsolenobia banatica* HERING (Abb. 1, 2)

Lit. : Herkulesbad (Domogledmassiv) (HERING 1922, REBEL 1927, CAPUSE 1964).

Die Art wurde 1922 nach einem Männchen, von den Kalkfelsen des Domogled stammend, beschrieben, welches sich heute im Naturkundemuseum Berlin befindet. Später ist *P. banatica* noch von CZEKELIUS (REBEL 1927) und CAPUSE (1964) am locus typicus gesammelt sowie durch Letzteren auch das Weibchen beschrieben worden. Die Autoren fanden am 30.4. und 1.5. die Raupen und bereits angesponnene Säcke an sonnigen bis halbschattigen Stellen in der näheren Umgebung des weißen Kreuzes am Domogled. Weiterhin konnte die Art auch in der Felslandschaft am Eisernen Tor aufgefunden werden. Zwischen dem 1.5. und 4.5. fanden wir die Säcke, die hier nicht das schwärzliche Aussehen der Domogledstücke haben sondern bräunlichgrau sind, in großer Zahl, zum Teil schon mit verlassenen Puppenhüllen. Daneben gelangen Beobachtungen von Männchen, die tagsüber an Felsen, besonders in Vertiefungen und unter kleinen Überhängen sitzen. Bei der Zucht schlüpften die Männchen von 18.00 bis 07.00 Uhr und die Weibchen zwischen 24.00 und 07.00 Uhr früh. Im allerersten Morgenlicht, etwa ab 06.00 Uhr beginnen die Männchen auf der Suche nach den Weibchen um die Felsen zu schwärmen. Ein frischgeschlüpftes und am 4.5. ausgesetztes Weibchen wurde von den umherfliegenden Männchen im Gelände nicht angeflogen, obwohl das Weibchen lockte und sich direkt im Lebensraum befand.

Insgesamt erlangten die Autoren durch Fang und Zucht etwa 70 Männchen und 13 Weibchen. Die Genitaluntersuchungen der Männchen erbrachten Übereinstimmung der Population vom Eisernen Tor mit der vom Domogled und die Messungen ergaben folgende Indices : 1,08-1,39 ; $\bar{x}$ = 1,29 ; n = 6.

6. *Siederia* sp.

Das vorliegende Material gehört einer noch unbekannten Art an. Die gattungsmäßige Zuordnung ist aufgrund habitueller und genital-morphologischer Besonderheiten noch nicht abgesichert. Vorerst wird die Art, die an anderer Stelle beschrieben wird, provisorisch *Siederia* MEIER zugeordnet. Die Fundplätze befinden sich in der näheren Umgebung von Petroşani.

7. *Taleporia tubulosa* RETZ.

Lit. : Herkulesbad (REBEL 1911), Riu-mare (Retyezat) (DIOSZEGHY 1929/30), Timişoara (Casa Verde) (POPESCU-GORJ 1964), Herculane (Poiana Feregari) (POPESCU-GORJ 1985).

Besonders in Waldungen in Menge festgestellt, weiterhin in Auenlandschaften und Felstälern : Herkulesbad, Eisernes Tor (nicht in der xerothermen

Abb. 1 : *Postsolenobia banatica* HERING (Männchen), (10 mm, Flügelspannweite). Rumänien, Herkulesbad, Domogled, Weißes Kreuz, 15.05.1986 e.p.

Abb. 2 : Habitat von *Postsolenobia banatica* HERING. (Vordergrund). Rumänien, Herkulesbad, Domogled, Weißes Kreuz, 01.05.1986.

Felsflur), Armeniş, Caransebeş, Poarta du Fier (700 m), 1 km W Petroşani, Jiul-Felstal, 10 km E Haţeg, Haţeg-Nord, Zam.

8. *Eumasia parietariella* H.-S.

Lit. : Herkulesbad (REBEL 1927).

Je einen besetzten Sack am 2.5. (Eisernes Tor) und 6.5. (Jiul-Felstal) in südexponierter Felslandschaft.

9. *Melasina lugubris* HB. (Abb. 3).

Lit. : Puj (CZEKELIUS 1897), Mehadia (FRIVALDSKY 1873 nach REBEL 1911), Herkulesbad (ABAFI-AIGNER *et al.* 1896 nach REBEL 1911), Galben, Fata fetelor (Retyezat) (DIOSZEGHY 1929/30), Retezat (KÖNIG 1975).

Uns gelang der Nachweis am Eisernen Tor : 1. bis 4.5. etwa 20 besetzte Säcke jeder Größe (Schlupf je 1 Männchen am 12., 13. und 17.8.), 1 km W Petroşani am 5.5. 1 besetzter Sack und 10 km E Haţeg etwa 10 besetzte Säcke an Gneisfelsen. Alle Stücke an südexponierten Stellen.

Abb. 3 : *Melasina lugubris* HB. (Männchen), (21,5 mm). Rumänien, Orşova, Eisernes Tor, 12.08.1986.

10. *Bacotia sepium* SPR.

Nur drei Einzelfunde aus dem nördlichen Teil des Untersuchungsgebietes : 8.8. 1 besetzter und 1 leerer Sack an Straßenleitplanken bei Haţeg-Nord, 9.5. 1 leerer Sack an Granitfelsen bei Lipova.

11. *Proutia betulina* Z.

Lit. : Ineu (Arad) (Popescu-Gprj 1964).

Ebenfalls nur im Norden des Gebietes beobachtet : 8.5. besetzte Säcke in großer Zahl bei Haţeg-Nord, 9.5. 1 leerer Sack an Granit bei Lipova. Zucht : 13 Männchen zwischen dem 18.5. und 17.6. sowie 2 Weibchen 19.6. und 20.6. (Haţeg-Nord).

12. *Bruandia comitella* Brd. (Abb. 4).

Lit. : Straße Mehadia-Herkulesbad (Popescu-Gorj 1985).

Am 5. und 6.5. wurden in der Jiul-Felsschlucht einige Säcke gesammelt, die auf *P. crassiorella* hindeuteten, aus denen aber drei *B. comitella*-Männchen schlüpften : 28.5., 2.6. und 5.6.

Abb. 4 : *Bruandia comitella* Brd. (Männchen), (13,5 mm). Rumänien, Petroşani, Jiul-Schlucht, 02.06.1986 e.p.

13. *Psyche casta* Pall.

Lit. : Gura apei (Retyezat) (Dioszeghy 1929/30), Ineu (Arad) (Popescu-Gorj 1964), Herkulesbad (Popescu-Gorj 1985).

Die Art konnte verbreitet, aber nie häufig beobachtet werden, so bei Herkulesbad, Eisernes Tor, Armeniş, Caransebeş, 1 km W Petroşani, 8 km E Petroşani (600 m), Jiul-Felstal, Haţeg-Nord, Ilteu und Lipova.

Zuchtergebnisse : 7 Männchen 22.5.-14.6. 1 km W Petroşani
5 Männchen 17.5.-20.5. Haţeg-Nord.

14. *Psyche crassiorella* Brd.

Lit. : Herkulesbad (Hedemann 1897, Rebel 1911), Gura apei (Reteyzat) (Dioszeghy 1929/30), Steierdorf (Caras) (Popescu-Gorj 1964).

Fast überall vorkommend, stellenweise besonders häufig an exponierten Hängen : Eisernes Tor, Herkulesbad, Straße Herkulesbad-Baia de Arama,

Orşova, Armeniş, 1 km W Petroşani, Jiul-Felstal, 8 km E Petroşani (600 m), 10 km E Petroşani (700 m), Lugoj, Zam. Zuchtdaten : Eisernes Tor – 1 Männchen 17.6., 2 Weibchen 18.5.

15. *Bijugis bombycella* SCHIFF. (Abb. 5).

Lit. : Kasan (FRIVALDSKY 1873 nach REBEL 1911), Mehadia (ABAFI-AIGNER *et al.* 1896 nach REBEL 1911), Herkulesbad, Orsova (REBEL 1911), Gura apei, Lăpuşnicul mare 1200 m (Retyezat) (DIOSZEGHY 1929/30), Ineu (Arad), Mt. Retezat (POPESCU-GORJ 1964), Mt. Paring (NEMES & DANILA 1970), Eşelniţa, Remetea Mare, Remetea Mica, Fibiş, Herkulesbad, Timişoara (KÖNIG 1975).

Lediglich ein Einzelnachweis : am 8.5. ein Raupensack am Fuße einer Eiche inmitten eines Eichenbestandes bei Haţeg-Nord. Schlupf des Weibchens am 5.6., welches etwa 4 Wochen lebte und mit Einbruch der Dämmerung bis 23.00 Uhr lockte.

Abb. 5 : *Bijugis bombycella* SCHIFF. (Lockendes Weibchen und Sack), (Länge des Sackes : 20 mm). Rumänien, Haţeg, 26.06.1986.

16. *Rebelia nudella* O.

Am 28.5.1983 an einem Pappelstamm ein angesponnener Sack. Die Fundstelle befindet sich inmitten einer Agrarlandschaft in der Nähe von Nădlac am Rasenstreifen einer Landstraße. Der Schlupf des Männchens erfolgte am 30.5.1983.

Abb. 6 : *Rebelia* cf. *kruegeri* Trti. (Männchen), (15,5 mm). Rumänien, Orşova, Eisernes Tor, 23.05.1986 e.l.

Abb. 7 : *Rebelia* cf. *kruegeri* Trti. (Weibchen und Sack), (Länge des Sackes : 20 mm). Rumänien, Orşova, Eisernes Tor, 23.05;1986 e.l.

17. *Rebelia* cf. *plumella* O.

Lit. : Lăpişnicula mare (1200 m) (Retyezat) (DIOSZEGHY 1934), Hunedoara (POPESCU-GORJ 1964), Bazos, Cheveres, Timişoara, Remetea Mare (KÖNIG 1975).

1 Männchen flog am 8.5. gegen 21.00 Uhr bei Dunkelheit an die Innenbeleuchtung des Autos unweit von Gurasada.

18. *Rebelia* cf. *kruegeri* TRTI. (= *marpessa* SIEDER) (Abb. 6, 7).

Säcke unterschiedlicher Größe z.T. in großer Zahl in Felsspalten und unter kleinen Vorsprüngen an den Xerothermhängen des Eisernen Tores zwischen dem 1.5. und 4.5. Die Schlupfzeiten bestätigen die Zuordnung zu den Rebelien-Frühfliegern :

Männchen – je 1 Ex. am 31.5., 4.6. (07.00 Uhr), 9.6. und 10.6.
Weibchen – 2 Ex. 18.5., 1 Ex. 23.5. (08.00 Uhr).

Nach HÄTTENSCHWILER in litt. 1988 ist *R. marpessa* SIEDER synonym zu *R. kruegeri* TRTI.

19. *Rebelia* sp.

An folgenden Orten Rebeliensackfunde, die nicht näher determiniert werden können : Armeniş, 1 km W Petroşani, 10 km E Haţeg (Trockenrasen);

20. *Epichnopterix kovacsi* SIEDER (Abb. 8).

Lit. : Mt. Remetea (= Remetea Mare, NEMES & DANILA 1970), Cheile Nerei, Mt. Domogled, Timişoara, Remetea Mare (KÖNIG 1975), Ciudaniviţa (Oraviţa) (POPESCU-GORJ 1985). Als *E. pulla* ESP. (= *E. plumella* DEN. & SCHIFF) geführt : Orşova, Kasanenge (REBEL 1911), Timişoara (Casa Verde), Ineu (Arad) (POPESCU-GORJ 1964).

Abb. 8 : *Epichnopteryx kovacsi* SIEDER. (Männchen), (12,5 mm). Rumänien, Orşova, Eisernes Tor, 10.05.1986 e.p.

Leere und besetzte Säcke in der Felssteppe am Eisernen Tor zwischen dem 1. und 4.5. in großer Zahl. Weiterhin 1 km W Petroşani an Felsen am 5.5. zwei leere und ein besetzter Sack, 10 km E Haţeg auf Frischwiesen im Flußauenbereich am 8.5. acht besetzte Säcke und eine leerer Sack sowie auf Frischkräuterrasen bei Gurasada am 9.5. zwei weibliche Säcke.

Zuchtergebnisse : Eisernes Tor – Männchen 7 Ex. 4.-16.5.
Weibchen 1 Ex. 10.5., 2 Ex. 18.5.
10 km E Haţeg – Männchen 1 Ex. 6.5., 1 Ex. 10.5.
Weibchen 1 Ex. 12.5.
1 km W Petroşani – Männchen 1 Ex. 16.5.
Gurasada – Weibchen 1 Ex. 15.5.

Bemerkungen : Ein Anflugversuch am 17.5.1986 bei Freiburg i. Breisgau und am 18.5.1986 bei Rastatt i. Baden erbrachte mittels eines unbefruchteten Weibchens von Gurasada jeweils innerhalb einer halben Stunde ca. 50 Männchen von *E. plumella* Den. & Schiff. Aus den befruchteten Eiern schlüpften Mitte Juni etwa 2 Dutzend Raupen, 1 Raupe überwinterte fast erwachsen und am 15.3.1987 schlüpfte um 08.00 Uhr mitteleuropäische Zeit ein Männchen. Der erfolgreiche Anflugversuch deutet auf bestehende enge Verwandschaft zu *E. plumella* Den. & Schiff. hin.

21. *Canephora unicolor* Hfn.

Lit. : Herkulesbad, Orşova (Rebel 1911), Retyezat (Dioszeghy 1929/30), Ineu (Arad) (Popescu-Gorj 1964), Padurea Ghiroc, Timişoara, Remetea Mare (König 1975).

Verbreitet und stellenweise häufig in Waldhabitaten und Felsfluren : Eisernes Tor, Herkulesbad, Orşova, 1 km W Petroşani, Jiul-Felstal, Haţeg-Nord, Lugoj, Gurasada.

Zuchtdaten : 12 Männchen 6.6.-3.7.1984 e.o. Herkulesbad
3 Männchen 16.-27.5. Lugoj
3 Männchen 23.5.-12.6. Eisernes Tor
6 Männchen 10.-20.6. Haţeg-Nord
1 Weibchen 17.5. Gurasada.

22. *Pachythelia villosella* O.

Lit. : Timişoara, Remetea Mare (König 1975).

Ebenfalls verbreitet, jedoch nur wenige Sackfunde an Warmtrockenstellen : Orşova (1983 Häufig), Eisernes Tor, Gurasada (1 Sack an einem Schlehenstrauch angesponnen).

Schlupf : Je 1 Männchen am 18.5. und am 16.6.1986 vom Eisernen Tor. Aus einer Eizucht von 1983 schlüpfte am 29.6.1985 ein Männchen (Orşova).

23. *Megalophanes viciella* DEN. & SCHIFF. (Abb. 9).

Lit.: Ineu (Arad) (POPESCU-GORJ 1964), Ghiroda, Timişoara, Remetea Mare (KÖNIG 1975).

Am 9.5.1986 wurden bei Gurasada etwa 40 Säcke gesammelt. Diese waren in niederen Vegetation bereits angesponnen.

Schlupf: 9 Männchen vom 19.5.-24.5.1986.

Abb. 9: *Megalophanes viciella* DEN. & SCHIFF. (Sack), (Länge des Sackes: 22 mm). Rumänien, Gurasada, 09.05.1986.

24. *Sterrhopterix fusca* HAW.

Lit. : Zănoaga 2000 m (DIOSZEGHY 1929/30), Ineu (Arad) (POPESCU-GORJ 1964), Pad. Chevereş (KÖNIG 1975).

Am 8.5. etwa 10 z.T. angesponnene Säcke an Straßenleitplanken bei Haţeg-Nord. Weiterhin am 9.5. ein männlicher und weiblicher Sack ebenfalls an Straßenleitplanken bei Gurasada. Bemerkenswert erscheint daß die Entwicklung bei Gurasada offensichtlich in einem Frischrasenhabitat erfolgte und nicht in einem Waldgebiet.

Schlupf : Je 1 Männchen am 18.5., 20.5. und Ende 5. (Haţeg-Nord).

Bemerkung : Der Nachweis bei DIOSZEGHY (1929/30) beruht sicherlich auf einem Irrtum. Die Höhenlage weist eventuell auf *S. standfussi* WOCKE hin.

25. *Oreopsyche plumifera* O.

Leere Säcke in Anzahl an den Felsen des Eisernen Tores. Aus den eingetragenen Säcken schlüpften bereits am 3.5. Jungraupen.

26. *Apterona helix* SIEB.

Lit. : Ineu (Arad) (POPESCU-GORJ 1964).

Nachweise an folgenden Orten : Eisernes Tor, Armeniş, Jiul-Felstal (bis 700 m), 6 km östlich von Petroşani, 10 km östlich von Haţeg, Haţeg-Nord, Zam, Toc, Nicolae Balcescu. Säcke z.T. recht häufig an Felsen, Straßenpfählen und Straßenleitplanken.

Weitere in der Literatur für das Untersuchungsgebiet angegebene Arten :

1. *Diplodoma herminata* GEOFF. : Borescul mare (1300 m) (Retyezat) (DIOSZEGHY 1934), Herkulesbad (HEDEMANN 1897, REBEL 1911).

2. *Pseudobankesia dioszeghyi* RBL. : Retyezat (900 m) (REBEL 1934). Die als *Bankesia* beschriebene Art stellte sich nach der Untersuchung des Holotypus (im Nationalmuseum Budapest) als eine *Pseudobankesia* heraus (HÄTTENSCHWILER in litt. 1987 an WEIDLICH).

3. *Siederia pineti* Z. : Mehadia (REBEL 1911), Gura apei (989 m) (Retyezat) (DIOSZEGHY 1929/30). Die Determinationen sind sehr zweifelhaft und es handelt sich wohl um eine andere Talaeporiinae-Species.

4. *Siederia alpicolella* RBL. : Ciocă (900-1400 m) (Retyezat) (DIOSZEGHY 1929/30). Diese Specie ist nach dem heutigen Erkenntnisstand auf den Alpenraum beschränkt und es handelt hier sehr wahrscheinlich um eine Fehldetermination.

5. *Talaeporia politella* O. : Mehadia (REBEL 1914). Obwohl REBEL 1 Männchen vorlag (leg. MANN 1859), ist das Vorkommen in den Südkarpaten

sehr zweifelhaft. Ein Nachweis dieses pannonischen Faunenelementes wäre am ehesten in der Banater Tiefebene zu erwarten.

6. *Bijugis pectinella* SCHIFF. : Fibiş (POPESCU-GORJ 1985).

7. *Rebelia surientella* BRD. : Orşova (REBEL 1911).

8. *Lepidoscioptera plumistrella* HB. : Gura zlata (801 m) (Retyezat) (DIOSZEGHY 1929/30). Gesicherte Vorkommen dieser Art liegen bisher nur aus dem Alpenraum vor.

9. *Megalophanes viadrina* STDGR. : Herkulesbad (PAVEL 1886 nach REBEL 1911), Mehadia (ABAFI-AIGNER *et al.* 1896 nach REBEL 1911). Entsprechend DIERL (1977) stellt *M. viadrina* eine Subspecies von *M. stetinensis* HERING dar. POPESCU-GORJ (1984) verzeichnet als einzige rumänische *Megalophanes* – Art *M. viciella* DEN. & SCHIFF.

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Tentative reclassification of holarctic Yponomeutoidea (Lepidoptera) (*)

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Summary

The informal genus-groups of the superfamily Yponomeutoidea previously defined by the author (Ent. scand. 15 : 71-84, 1984) are classified in seven families, the Yponomeutidae, Ypsolophidae, Plutellidae, Glyphipterigidae, Heliodinidae, Bedelliidae and Lyonetiidae. The first family is composed of six subfamilies and the others, except the Heliodinidae and Bedelliidae, each of two subfamilies. The family classification is based on 50 possible apomorphies which are briefly discussed. Difficulties in assigning the Lyonetiidae to the correct clade are reviewed. Holarctic yponomeutoid genera, genera which have been excluded from the superfamily and genera which have not been available for study are listed in appendices A, B and C. Four new generic synonyms in the Yponomeutoidea are mentioned and the subfamily Galacticinae is upgraded to family rank to include four genera, which have been excluded from the Yponomeutoidea.

A reassessment of the superfamily Yponomeutoidea and its constituent groups was published a few years ago (Kyrki 1984). At that time no formal classification, so necessary for all of us, was presented, but now, as more information has become available, a tentative reclassification can be proposed (Table 1). The classification is based on the examination of most holarctic yponomeutoid genera and also on many exotic ones, but slight amendments are still expected when tropical and southern hemisphere Yponomeutoids become better known. The hypothesized phylogeny of the superfamily is presented as a cladogram (Fig. 1). It has not yet been possible to trace the sister group of the Yponomeutoidea with certainty. Therefore the out-group comparisons have been carried out with the tineoid families which most probably form, either as a whole or in part, the sister group of the Yponomeutoidea. The monophyly of the included subfamilies was demonstrated earlier (Kyrki 1984, as genus groups) so the autapomorphies of the

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YPONOMEUTOIDEA STEPHENS, 1829

Yponomeutidae STEPHENS, 1829
- Scythropiinae FRIESE, 1966
- Yponomeutinae STEPHENS, 1829
  - (= *Hyponomeutinae* SODOFFSKY, 1837)
  - (= *Hofmanniinae* SPULER, 1910)
  - (= *Zelleriinae* TURNER, 1913)
  - (= *Cedestinae* KLOET & HINCKS, 1945)
- Saridoscelinae MORIUTI, 1977
- Attevinae MOSHER, 1916
- Praydinae MORIUTI, 1977
- Argyresthiinae BRUAND, [1851]

Ypsolophidae GUENÉE, 1845
- Ypsolophinae GUENÉE, 1845
  - (= *Hypsilophinae* HAMPSON, 1918)
  - (= *Cerostominae* BÖRNER, 1925)
- Ochsenheimeriinae HERRICH-SCHÄFFER, 1857

Plutellidae GUENÉE, 1845
- Plutellinae GUENÉE, 1845
- Acrolepiinae HEINEMANN, 1870

Glyphipterigidae STAINTON, 1854
- Orthoteliinae HERRICH-SCHÄFFER, 1857
- Glyphipteriginae STAINTON, 1854
  - (= *Aechmiidae* BRUAND, [1851])

Heliodinidae HEINEMANN, 1876

Bedelliidae MEYRICK, 1880

Lyonetiidae STAINTON, 1854
- Cemiostominae WALLENGREN, 1881
  - (= *Leucopterinae* CHAPMAN, 1902)
- Lyonetiinae STAINTON, 1854

Table 1. Tentative reclassification of the Yponomeutoidea.

subfamilies need not be repeated here. The Saridoscelinae (with only one genus, *Saridoscelis* MEYRICK) were separated from the *Yponomeuta* group sensu KYRKI 1984. Its diagnostic characters are listed by MORIUTI (1977) (as Saridoscelini).

Apomorphic characters of yponomeutoid families and groups of families. (For morphological descriptions and illustrations see further references in KYRKI (1984)).

Apomorphies of the Yponomeutoidea

1. Pleural lobes present in the 8th abdominal segment of adult males (see KYRKI 1984).
2. Transverse ridge on second abdominal sternite (see KYRKI 1983b).

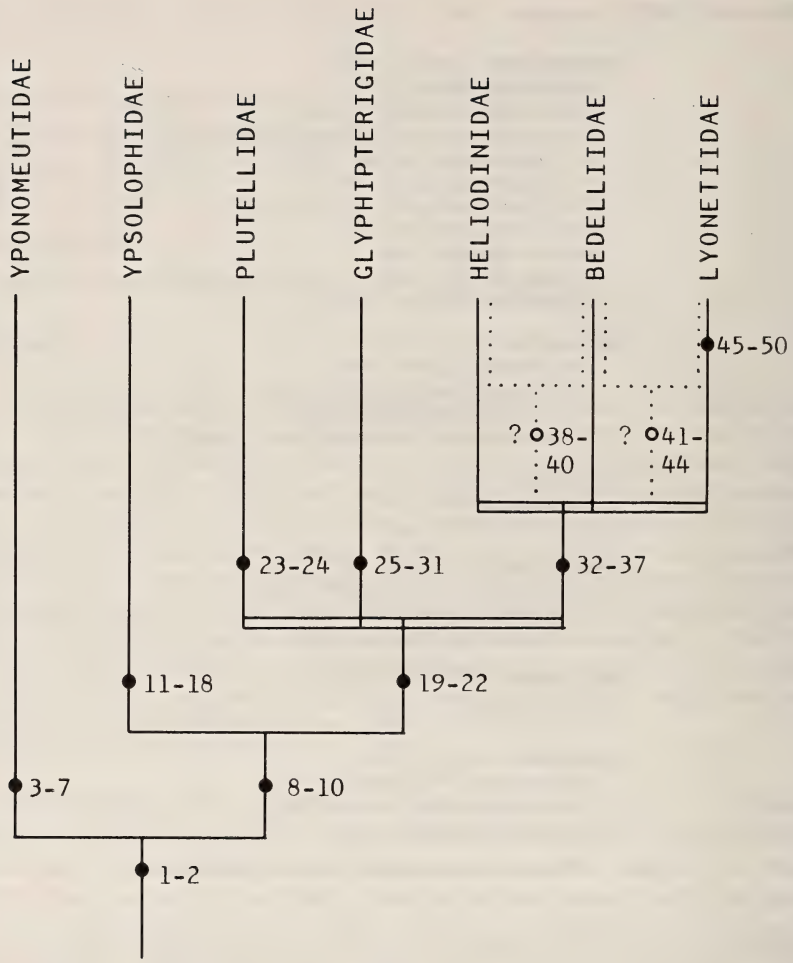

Fig. 1. Cladogram of yponomeutoid families. Numbers denote possible apomorphies discussed in the text. Double lines = unresolved trichotomies ; dotted lines = alternative phylogenetic hypotheses supported by characters 38-40 and 41-44 respectively.

Autapomorphies of the Yponomeutidae

3. Ocelli lost.
4. Pterostigma from Sc to R_1. (Except in the Scythropiinae ; character reversal or plesiomorphy). Pterostigma which extends only to R_1 is found also in the Ypsolophidae !
5. 8th abdominal sternite more strongly sclerotized than the 7th one. (Except in the Yponomeutinae).

6. Claws of larval thoracic legs long and fairly straight. (Except in the endophagous larvae of the Argyresthiinae).
7. Crochets of abdominal prolegs bi- or multiserial. (Except in the Argyresthiinae).

For the subfamily classification of the Yponomeutidae see the chapter "Classification of the Yponomeutidae".

Synapomorphies of families other than the Yponomeutidae

8. Second segment of labial palpus with ventral scale tuft (often reduced in the Acrolepiinae and Glyphipterigidae and not recorded at all in advanced families Heliodinidae, Bedelliidae and Lyonetiidae).
9. Abdominal prolegs longer than broad. In endophagous larvae of the Glyphipterigidae and Lyonetiidae the prolegs are secondarily short).
10. Larval 9th abdominal segment with only one SV seta. (Some ypsolophid species have 2 setae ; further investigation is needed to show whether this bisetose condition is better considered as a character reversal or a plesiomorphy).

Autapomorphies of the Ypsolophidae

11. Veins R_s and M_1 stalked (or even coincident) in hindwing.
12. Tegumen deeply bilobed at anterior margin.
13. Anellus a membranous, strongly spinose tube.
14. Aedeagus with two cornuti or cornuti groups.
15. Female with long anterior and posterior apophyses.
16. Ductus seminalis joins to ductus bursae near ostium.
17. Signum elongated plate with two transverse ridges.
18. Pupa without cremaster setae.

Synapomorphies of families Plutellidae to Lyonetiidae

19. Gnathos absent.
20. Tegumen reduced in size, on dorsal side at most a narrow transverse band.
21. Pupal thoracic spiracle protruded (except in the Lyonetiidae ; see the discussion of the systematic position of the family).
22. Larvae feed on grasses and herbs (see Table 4 and the discussion of the systematic position of the Lyonetiidae).

Autapomorphies of the Plutellidae

23. Lamella postvaginalis consisting of two setose lobes.
24. Cocoon large meshed.

Autapomorphies of the Glyphipterigidae

For a more thorough discussion of the larval characters see Kyrki & Itämies (1986).

25. Antennal scape without pecten.

26. Teguminal processes reduced, absent (misinterpreted by KYRKI 1984, see KYRKI & ITÄMIES 1986).
27. Cranial setae F_1, Af_1, Af_2, A_2, P_2, O_1, O_3 and SO_2 short.
28. Prothoracic L group bisetose.
29. 8th abdominal spiracle on dorsal side, near the hind margin of the segment.
30. Larva endophagous.
31. Larvae primarily feeding on monocotyledons (see Table 4 ; Heppner recently (1985) listed also Piperaceae and Urticaceae as host plant families for the Glyphipterigids).

Synapomorphies of Heliodinidae, Bedelliidae and Lyonetiidae

32. Maxillary palpus reduced, at most 2 segments.
33. Altogether at most 4 M and CuA veins present in forewing.
34. Discal cell open in hindwing.
35. No distinct sclerite for the maxillary palpus in pupa.
36. Pupal abdominal segments not movable.
37. Pupa with strong lateral ridges.

The families Heliodinidae, Bedelliidae and Lyonetiidae form still unresolved trichotomy. Two alternative phylogenetic hypotheses (Heliodinidae + Bedelliidae) + Lyonetiidae and Heliodinidae + (Bedelliidae + Lyonetiidae) are supported by three and four characters respectively.

Possible synapomorphies of Heliodinidae and Bedelliidae

38. Larva with long spinneret.
39. Seta V_1 not apparent in thoracic segments.
40. Larva pupates without cocoon.

Possible synapomorphies of Bedelliidae and Lyonetiidae

41. Ocelli absent.
42. Adult with scale tuft between antennae.
43. Hind tibia hairy on dorsal side.
44. Fringe on underside of labrum of larva very prominent.

Autapomorphies of the Lyonetiidae

45. Antennal scape slightly flattened and bordered with scales, at rest forming an eye-cap.
46. Forewing caudate.
47. Head of larva flattened.
48. Cranial setae F_1, Af_1, Af_2, P_2, L_1 and O_3 short.
49. Labrum at most with four pairs of setae on dorsal side.
50. Abdominal dorsal setae D_1 and D_2 close to each other, D_1 situated lower (more laterad) than D_2.

Classification of the Yponomeutidae

It has not yet been possible to present a well founded phylogenetic hypothesis for the subfamilies of the Yponomeutidae. Five out of the six subfamilies are represented by one or only a few genera in the holarctic region and show but little variation. The advanced characters of the subfamilies presented in Tables 2 and 3 demonstrate that there must have been a considerable amount of character reversals and/or parallel evolution during the evolution of the family. The Scythropiinae may be the sister group of all other families, if its pterostigma really is a plesiomorphic character (see character 4 in the text). The Saridoscelinae and Yponomeutidae seem to be sister groups (Table 2 :

Characters	1	2	3	4	5	6	7	8	9	10	11	12	13
Scythropiinae	○	○	○	○	●	○	○	○	●	○	○	●	○
Saridoscelinae	○	○	●	●	●	●	●	○	●	●	●	●	○
Yponomeutinae	○	○	●	●	○	●	○	○	●	●	●	●	○
Attevinae	●	●	○	●	●	○	○	●	○	○	●	●	○
Praydinae	●	●	○	●	●	○	○	●	○	○	○	●	●
Argyresthiinae	○	●	○	●	●	○	●	○	○	○	○	○	●

Table 2. Distribution of possible synapomorphies (black dots) in the subfamilies of the Yponomeutidae. Characters 1-13 are explained in Table 3.

Character	plesiomorphic (○)	apomorphic (●)
ADULT		
1. antennal scape	with pecten	without pecten
2. maxillary palp	4 segments	less than 4 segments
3. abdominal terga	with normal scales	with scales and spines (specialized scales)
4. pterostigma from Sc	to R_2 or R_3	to R_1
5. 8th abd. sternite	sclerotized as the 7th	more strongly sclerotized than the 7th
6. aedeagus	without basal scape	with basal scape
7. teguminal processes	unscaled	with specialized scales
LARVA		
8. cranial seta P_1	lower than Af_2-P_2 line	on line with or higher than Af_2-P_2
9. cranial seta V_1	short	long
10. ventral margin of mandible	evenly arched	bulged
11. antennal segments 3 + 4	shorter than segments 1 + 2	longer than segments 1 + 2
12. crochets	uniserial	bi- or multiserial
13. larva	exophagous, often in web	endophagous

Table 3. Characters 1-13 of the subfamilies of the Yponomeutidae. See Table 2.

	conifers		dicotyledons																							monocots						
	trees, bushes and dwarf shrubs																					grasses and herbs										
	Pinaceae	Cupressaceae, Taxodiaceae	Rosaceae	Ericaceae	Betulaceae	Fagaceae	Celastraceae	Oleaceae	Rhamnaceae, Santalaceae	Empetraceae, Epacridaceae	Grossulariaceae	Simarubaceae	Caprifoliaceae	Rutaceae, Juglandaceae	Salicaceae	Aceraceae	Ulmaceae	Myricaceae	Rubiaceae	Crassulaceae	Saxifragaceae	Brassicaceae, Capparidaceae	Solanaceae, Asteraceae	Chenopodiaceae, Nyctaginaceae	Convolvulaceae, Urticaceae	Fabaceae, Guttiferae	Poaceae	Juncaceae	Liliaceae	Dioscoreaceae, Orchidaceae	Cyperaceae	Iridaceae, Sparganiaceae	Araceae
Scythropiinae			•																														
Yponomeutinae	•		•	•	•	•	•	•	•	•	•									•	•											
Saridoscelinae				•																												
Attevinae												•																				
Praydinae					•			•					•	•																		
Argyresthiinae	•	•	•	•	•	•									•																	
Ypsolophinae	•		•		•	•	•						•			•	•															
Ochsenheimeriinae																										•	•					
Plutellinae																						•										
Acrolepiinae																							•					•	•			
Orthoteliinae																										•				•	•	
Glyphipteriginae																				•						•	•			•		•
Heliodinidae																								•								
Bedelliidae																									•							
Lyonetiinae			•	•	•	•									•			•								•		•		•		
Cemiostominae			•		•		•								•	•			•							•			•			

Table 4. Foodplant families of yponomeutoid families and subfamilies. Summarized from literature records.

synapomorphies 3, 6 and 10 and possible synapomorphies 9 and 11 which are parallelled in other subfamilies). There is also some evidence of a close relationship between the Attevinae and Praydinae (Table 2 : characters 1, 8 and possibly 2), but at least characters 1 and 2 are reductions which are parallelled many times in the evolution of the Lepidoptera. The endophagous larvae of the Argyresthiinae are highly specialized due to their mode of life, but otherwise I have not found good reasons for excluding the subfamily from the Yponomeutidae as a distinct family as several recent authors do (e.g. INOUE *et al.* 1982, HEPPNER 1984).

Systematic position of the Lyonetiidae

The systematic position of the Lyonetiidae within the superfamily is still in need of careful re-examination in spite of the fact that the characters 32 to 37 presented in the foregoing text seem to demonstrate the close relationship of the Lyonetiidae, Bedelliidae and Heliodinidae. The Lyonetiids do not have apomorphies 8, 9, 21 or 22 listed in the cladogram for their stem groups. The lack of the scale tuft from the labial palpus and short larval prolegs might well be reductions. The plesiomorphic position of the pupal thoracic spiracle and the foodplant spectrum of primitive Lyonetiids, which is similar to that of Yponomeutids and Ypsolophids (Table 4), might probably, together with a few other characters (ocellus absent, cocoon double, crochets partly biserial in the primitive lyonetiid genus *Paraleucoptera*) place the family Lyonetiidae close to the Yponomeutidae, either as a sister group or even as a specialized subfamily.

APPENDIX A

Checklist of Holarctic yponomeutoid genera

The genera are listed alphabetically within each subfamily because most families and subfamilies have not been critically revised. Three genera whose exact systematic position within the superfamily is not known to the author, are listed separately at the end of the checklist. Synonymic names of the genera are listed only in those cases in which they differ from those given in the checklists of LERAUT (1980), INOUE *et al.* (1982) and HODGES *et al.* (1983). A few new generic synonyms are included. The occurrence of the genera in the western Palaearctic, eastern Palaearctic and Nearctic regions (WP, EP and NA respectively) is tabulated. Four genera are recorded for the first time from the nearctic region : *Euhyponomeutoides* GAJ, with *E. gracilariella* (BUSCK, 1904) **comb. n.** from *Zelleria* ; *Atemelia* HERRICH-SCHÄFFER, with *A. aetherias* (MEYRICK, 1927) **comb. n.** from *Orinympha* ; *Eidophasia* STEPHENS, with *E. dammersi* (BUSCK, 1934) **comb. n.** from *Plutella* ; *Rhigognostis* with *R. interrupta* (WALSINGHAM, 1881) **comb. n.** and *R. poulella* (BUSCK, 1904) **comb. n.** from *Plutella.*

YPONOMEUTIDAE	WP	EP	NA
SCYTHROPIINAE			
Scythropia HÜBNER, [1825]	o		
YPONOMEUTINAE			
Banghaasia FRIESE, 1960	o		
Cedestis ZELLER, 1839	o	o	
Choutinea HUANG, 1982		o	
Eucalantica BUSCK, 1904			o
Euhyponomeuta TOLL, 1941	o	o	
Euhyponomeutoides GAJ, 1954	o	o	o
(= *Nordmaniana* FRIESE, 1960)			
Eumonopyta MORIUTI, 1977		o	
Kessleria NOWICKI, 1864	o	o	o
Klausius MORIUTI, 1977		o	
Lampresthia MORIUTI, 1977		o	
Metanomeuta MEYRICK, 1935		o	
Niphonympha MEYRICK, 1914	o	o	
Ocnerostoma ZELLER, 1847	o	o	o
Paraswammerdamia FRIESE, 1960	o	o	
Pseudoswammerdamia FRIESE, 1960	o		
Swammerdamia HÜBNER, [1825]	o	o	o
Teinoptila SAUBER, 1902		o	
Thecobathra MEYRICK, 1922		o	
Xyrosaris MEYRICK, 1907		o	
Yponomeuta LATREILLE, 1796	o	o	o
Zelleria STAINTON, 1849	o	o	o
SARIDOSCELINAE			
Saridoscelis MEYRICK, 1894		o	
ATTEVINAE			
Atteva WALKER, 1854			o
PRAYDINAE			
Atemelia HERRICH-SCHÄFFER, 1853	o	o	o
(= *Orinympha* MEYRICK, 1927, **syn. n.**)			
Eucatagma BUSCK, 1901			o
Prays HÜBNER, [1825]	o	o	
ARGYRESTHIINAE			
Argyresthia HÜBNER, [1825]	o	o	o
(= *Blastotere* RATZEBURG, 1840)			
(= *Paraargyresthia* MORIUTI, 1969, **syn. n.**)			

YPSOLOPHIDAE	WP	EP	NA
YPSOLOPHINAE			
Bhadorcosma MORIUTI, 1977		o	
Euceratia WALSINGHAM, 1881			o
Phrealcia CHRETIEN, 1900	o	o	
Rhabdocosma MEYRICK, 1935		o	
Ypsolopha LATREILLE, 1796	o	o	o
(= *Melitonympha* MEYRICK, 1927)			
OCHSENHEIMERIINAE			
Ochsenheimeria HÜBNER, [1825]	o	o	o
PLUTELLIDAE			
PLUTELLINAE			
Eidophasia STEPHENS, 1842	o	o	o
Lunakia KLIMESCH, 1941	o		
Plutella SCHRANK, 1802	o	o	o
Rhigognostis ZELLER, 1857	o	o	o
(= *Caunaca* WALLENGREN, 1880)			
(= *Eumachaeristis* MEYRICK, 1938, **syn. n.**)			
ACROLEPIINAE			
Acrolepia CURTIS, 1838	o		
Acrolepiopsis GAEDIKE, 1970	o	o	o
Digitivalva GAEDIKE, 1970	o	o	o
GLYPHIPTERIGIDAE			
ORTHOTELIINAE			
Orthotelia STEPHENS, 1829	o		
GLYPHIPTERIGINAE			
Abrenthia BUSCK, 1915			o
Carmentina MEYRICK, 1930		o	
Chrysocentris MEYRICK, 1914		o	
Drymoana HEPPNER, 1985			o
Glyphipterix HÜBNER, [1825]	o	o	o
(= *Diploschizia* HEPPNER, 1981, **syn. n.**)			
Lepidotarphius PRYER, 1877		o	
Neomachlotica HEPPNER, 1981			o

HELIODINIDAE	WP	EP	NA
Epicroesa MEYRICK, 1907		o	
Heliodines STAINTON, 1854	o		o
Lamprolophus BUSCK, 1900			o
Lithariapteryx CHAMBERS, 1876			o
Scelorthus BUSCK, 1900			o
BEDELLIIDAE			
Bedellia STAINTON, 1849	o	o	o
LYONETIIDAE			
CEMIOSTOMINAE			
Leucoptera HÜBNER, [1825]	o	o	o
Microthauma WALSINGHAM, 1891		o	
Paraleucoptera HEINRICH, 1918	o	o	o
Proleucoptera BUSCK, 1902		o	o
LYONETIINAE			
Lyonetia HÜBNER, [1825]	o	o	o
Systematic position within the Yponomeutoidea not known :			
Distagmos HERRICH-SCHÄFFER, 1853	o		
Phyllobrostis STAUDINGER, 1859	o		
Podiasa BUSCK, 1900			o

APPENDIX B

List of Holarctic genera, with their type species, which are currently listed in yponomeutoid families, although their true systematic position has not yet been verified.

Acanthocnemes CHAMBERS, 1878 *A. fuscoscapulella* CHAMBERS, 1878	Lyonetiidae (DAVIS, 1983)
Corythophora BRAUN, 1915 *C. aurea* BRAUN, 1915	Lyonetiidae (DAVIS, 1983)
Cycloplasis CLEMENS, 1864 *C. panicifoliella* CLEMENS, 1864	Heliodinidae (HEPPNER & DUCKWORTH, 1983)

Eulyonetia CHAMBERS, 1880 *E. inornatella* CHAMBERS, 1880	Lyonetiidae (DAVIS, 1983)

The genus might belong to the Gelechioidea, because the proboscis of the type species is said to be scaled (CHAMBERS, 1880).

Exegetia BRAUN, 1918 *E. crocea* BRAUN, 1918	Lyonetiidae (DAVIS, 1983)
Philonome CHAMBERS, 1874 *P. clemensella* CHAMBERS, 1874	Lyonetiidae (DAVIS, 1983)
Sporadarchis MEYRICK, 1935 *S. galactombra* MEYRICK, 1935	Yponomeutidae (MEYRICK, 1935)

APPENDIX C

List of Holarctic genera which have recently, or in the present paper, been excluded from families now placed in the Yponomeutoidea with their current family/superfamily assignment. The Galacticidae are hereby upgraded from subfamily to family rank.

Genus type species	current systematic position
Araeolepia WALSINGHAM, 1881 *A. subfasciella* WALSINGHAM, 1881	unknown, hereby excluded from the Plutellidae
Atrijuglans YANG, 1977 *A. hetaohei* YANG, 1977	Gelechioidea : (new assignment)
Bahrlutia AMSEL, 1935 *B. ghorella* AMSEL, 1935	Galacticidae (new status) (= *Homadaula* group sensu KYRKI, 1984)
Beijinga YANG, 1977 *B. utila* YANG, 1977	Gelechioidea : (new assignment)
Bucculatrix ZELLER, 1839 *B. albedinella* ZELLER, 1839	Bucculatricidae (KYRKI, 1984)
Conchiophora CHRÉTIEN, 1915 *C. spinosella* CHRÉTIEN, 1915	Gelechioidea : (new assignment)
Corsocasis MEYRICK, 1912 *C. coronias* MEYRICK, 1912	Schreckensteiniidae (new assignment)
Cyanarmostis MEYRICK, 1927 *C. vectigalis* MEYRICK, 1927	Gelechioidea : (new assignment)
Ellabella BUSCK, 1925 *E. editha* BUSCK, 1925	unknown, hereby excluded from the Plutellidae
Euprora BUSCK, 1906 *E. argentiliniella* BUSCK, 1906	hereby transferred back to the Tineidae (cf. DAVIS, 1983)

Eustixis HÜBNER, 1825 *E. pupula* HÜBNER, 1825 = *Lactura* WALKER, 1854 *L. dives* WALKER, 1854	Zygaenidae : Phaudinae (KYRKI in prep.)

For further synonyms see e.g. HEPPNER & DUCKWORTH (1983).

Galactica WALSINGHAM, 1911 *G. caradjae* WALSINGHAM, 1911	Galacticidae (new status) (= *Homadaula* group sensu KYRKI, 1984)
Homadaula LOWER, 1899 *H. lasiochroa* LOWER, 1899 = *Paraprays* REBEL, 1910 *P. punctigera* REBEL, 1910	Galacticidae (new status) (= *Homadaula* group sensu KYRKI, 1984)
Pliniaca BUSCK, 1907 *P. bakerella* BUSCK, 1907	unknown, hereby excluded from the Plutellidae
Roeslerstammia ZELLER, 1839 *R. erxlebeniella* ZELLER, 1839	Roeslerstammiidae (= Amphitheridae) (KYRKI, 1983a)
Schreckensteinia HÜBNER, 1825 *Tinea festaliella* HÜBNER, 1819	Schreckensteiniidae (see e.g. MINET, 1983 and KYRKI, 1984)
Staintonia STAUDINGER, 1859 *S. medinella* STAUDINGER, 1859 = *Exodomorpha* WALKER, 1864 **syn. rev.** *E. divisella* WALKER, 1864	Scythrididae (FALKOVITSH, 1981, BENGTSSON, 1984)

According to VIETTE (1956) the genus is not a junior synonym of *Eretmocera* ZELLER, 1852.

Syncrotaulella FLETCHER, 1940 *Syncrotaula strepsicentra* MEYRICK, 1937 = *Syncrotaula* MEYRICK, 1937 *S. strepsicentra* MEYRICK, 1937	Gelechioidea : (new assignment)
Urodus HERRICH-SCHÄFFER, [1854] *U. monura* HERRICH-SCHÄFFER, [1854]	Urodidae (KYRKI, 1988)
Wockia HEINEMANN, 1870 *W. funebrella* HEINEMANN, 1870	Urodidae (KYRKI, 1988)
Zarcinia CHRÉTIEN, 1915 *Z. nigrosignatella* CHRÉTIEN, 1915	Galacticidae (new status) (= *Homadaula* group sensu KYRKI, 1984)

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Glossotrophia annae sp. n. from Spain (Lepidoptera : Geometridae)

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Summary

A short review of *Glossotrophia* is given. *G. annae* sp. n. is described and compared with *G. confinaria* (H.-S. [1847]) and *G. asellaria* (H.-S. [1847]). *G. diffinaria* PRT. 1913 is reported as new for Europe.

Glossotrophia PRT.

Glossotrophia PROUT 1913 in SEITZ, The Macrolepidoptera of the World 1 (4) : 82. Type species : *Acidalia confinaria* H.-S. [1847] by original designation.

The German edition of the work of SEITZ (with the same date) contains an error regarding the number of spurs on the hindtibiae in females ("♀ ohne Sporen"), corrected in the English edition ("♀ with two spurs"). The essential point is, however, the absence of spurs in the middle of the hindtibiae in both sexes, only distal (or terminal) spurs being present.

Other characters in *Glossotrophia* as distinct from *Scopula* are the extremely long proboscis, the non-specialized hindtarsi and the terminal line on the forewings extending round the apex, the last character occurring also in some *Scopula.*

The genitalia in *Glossotrophia* are fundamentally of the same structure as in *Scopula* and extremely uniform throughout the genus, seldom showing specific characters. In females, specific characters occur sometimes in the ostium. In the males, valuable specific characters are present in the sclerotized eighth sternite with its free mappa and cerata (from kérata (Greek) = horns ; singular : ceras). This structure has always been considered as belonging to the genitalia, having evidently an important function during copulation. It was figured for the first time in the monographic work on the *Sterrhinae* by STERNECK (1940-1941).

Glossotrophia are distributed throughout the southern part of the western Palaearctic region. Twenty-four species have been described in the genus or subsequently referred to it, of which *G. similata* LE CERF 1924 from Eritrea and *G. moralesi* RUNGS 1945 from the Sahara belong to other genera.

Twenty-two species remain, of which three have been described from Europe (*G. asellaria* (H.-S. [1847]), *G. confinaria* (H.-S. [1847]), *G. rufomixtaria* (GRASL. 1863)), two from Africa (*G. tripolitana* TURATI 1930, *G. alfierii* WILTSHIRE 1949) and the remainder from Asia. Only one species has been reported to occur in more than one of these areas (*G. asellaria* in Europe and Africa). The occurrence of *G. asellaria* in Asia needs confirmation as well as of the genus on Teneriffa.

The male genitalia with the eighth sternite are still unknown for *G. fucata* (PÜNGELER 1908), *G. benigna* BRANDT 1941, *G. origalis* BRANDT 1941, *G. terminata* WILTSHIRE 1966, *G. bullata* VOJNITS 1986, all from the Middle East, and for *G. tripolitana* TURATI from Africa. The species from the Middle East are sufficiently different in habitus from *G. annae* sp. n. to necessitate consideration here. *G. tripolitana* will be discussed below.

Glossotrophia annae sp. n.
Figs. 1-2, 5, 8.

TYPE LOCALITY : Spain : Aragón : Province Zaragoza : Botorrita.

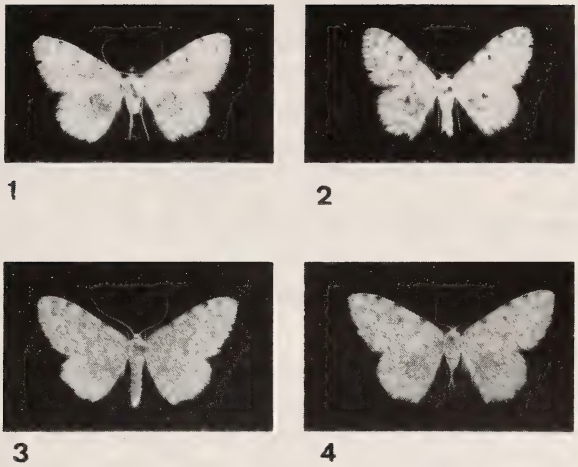
All types from Spain : Aragón.

HOLOTYPE : ♂, Botorrita 24.V.1985 (fig. 1), genital preparation E. v. MENTZER No. 12.076 (fig. 5), leg. and in coll. F. BOLLAND.

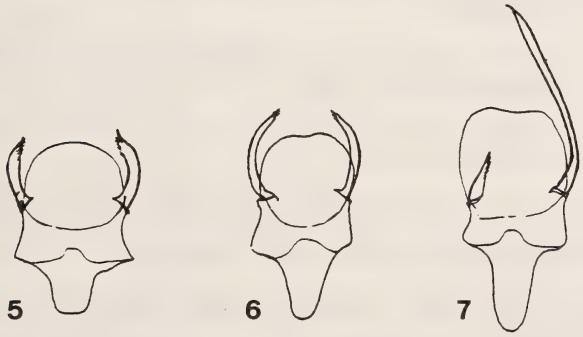
PARATYPES : 2 ♂♂ 1 ♀, Botorrita 24.V.1985 ; 1 ♂, Botorrita 25.IX.1984 ; 2 ♂♂, Bujalaroz 15.V.1987 ; 2 ♀♀, Bujalaroz 2.VI.1987 ; 1 ♀, Bujalaroz 29.IX.1981 ; 1 ♀, Barbastro 25.IX.1985 ; 1 ♀, Peñalba 26.IX.1983. Leg. and in coll. F. BOLLAND. – 1 ♀, Bujalaroz 3.VI.1983, prep. E. v. M. No. 12.077, leg. F. BOLLAND (fig. 8) ; 1 ♀, Botorrita 2.VI.1983, leg. F. BOLLAND ; 1 ♂, Peñalba 27.V.1983, prep. E. v. M. No. 12.066, leg. A. MOBERG. In coll. E. v. MENTZER.

ETYMOLOGY : After Anna Bolland (the wife of the collector), who found the first locality for *G. annae* sp. n.

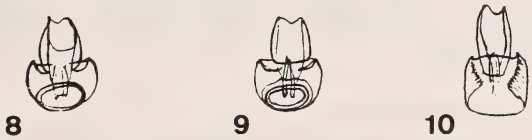
DESCRIPTION : ♂ and ♀ (figs. 1-2). Wingspan ♂♂ 21.5-26.5 mm (holotype 25.0 mm, $\bar{x}$ = 24.5 mm, n = 7), ♀♀ 20.5-26.0 ($\bar{x}$ = 23.9 mm, n = 8). Similar to pale specimens of *G. confinaria* (H.-S.) and to some extent also to slightly yellowish forms of *G. rufomixtaria* (GRASL.) ; body, antennae and wings including the fringes ivory-white, due to a mixture of white and pale yellowish grey scales as in *G. confinaria* ; crosslines with costal spots pale ochreous, rather diffuse but less so than in *G. confinaria*, sometimes obsolete, produced by the concentration of the pale yellowish grey scales ; terminal line brown, interrupted on the veins ; cell-dots pale brown, diffuse ; wings scantily irrorated dorsally with dark brown scales, chiefly in the median and apical



Figs. 1-4. *Glossotrophia* spp. — 1. *G. annae* sp. n. ♂ holotype, Spain : Aragón : Botorrita 24.V.1985. — 2. *G. annae* sp. n. ♀ paratype, Spain : Aragón : Bujalaroz 3.V.1983. — 3. *G. confinaria* (H.-S.) ♂, Italy : Piedmont : Ormea 9.VII.1954. — 4. *G. rufomixtaria* (GRASL.) ♀, Spain : Catalonia : Monte Caro 30.VI.1964. — Life size.



Figs. 5-7. Male genitalia (eighth sternite) in *Glossotrophia*. — 5. *G. annae* sp. n. holotype fig. 1, prep. No. 12.076. — 6. *G. rufomixtaria* (GRASL.), Italy : Umbria : Orvieto 10.VIII.1958, prep. No. 12.022. — 7. *G. confinaria* (H.-S.), Italy : Lombardy : Val Travaglia 4.VII.1954, prep. No. 7.024. — × 18,, ventral view.



Figs. 8-10. Female genitalia (ostium) in *Glossotrophia*. — 8. *G. annae* sp. n. paratype, Spain : Aragón : Bujalaroz 3.VI.1983, prep. No. 12.077. — 9. *G. rufomixtaria* (GRASL.) fig. 4, prep. No. 7.026. — 10. *G. confinaria* (H.-S.), Yugoslavia : Macedonia : Matka (near Skopje) 15.VIII.1979, prep. No. 7.029. — × 18, ventral view.

areas and on the crosslines, not densely distributed over the whole wing surface as in *G. confinaria* and *G. rufomixtaria*, the irrorating scales arranged linearly in the apical region of the forewings, as at least in the terminal area in *G. rufomixtaria, G. asellaria* and *G. diffinaria* PROUT (e.g. STERNECK 1941 : 106) ; proboscis long as in *G. confinaria* and *G. rufomixtaria* ; antennae without specific characters ; hindtibial spurs in the male of varying length and number, from none to two, the number differing sometimes in the same individual (two spurs in *G. asellaria*, one in *G. confinaria* and *G. rufomixtaria*, none in *G. diffinaria*), always two spurs in the female (as in *G. asellaria, G. confinaria* and *G. diffinaria*, for the last species not published earlier).

GENITALIA ♂ (fig. 5) : clasping structure and aedeagus without specific characters ; eighth sternite with appendices similar to those in *G. rufomixtaria* (fig. 6) but more robust, the sternite and mappa shorter and larger and the cerata thicker ; the two cerata of equal length, short, hardly exceeding the mappa, strongly feathered inwardly along the distal part, highly different from those in *G. confinaria* (fig. 7) where the fully developed right ceras is nearly twice as long as the mappa, from those in *G. asellaria* which has vestigial cerata and from *G. diffinaria* with both cerata "fully developed" (STERNECK 1941 : 107, not figured).

GENITALIA ♀ (fig. 8) : Ostium as in *G. rufomixtaria* (fig. 9), clearly different from that in *G. confinaria* (fig. 10).

Glossotrophia asellaria (H.-S.)

Acidalia asellaria HERRICH-SCHÄFFER [1847], Systematische Bearbeitung der Schmetterlinge von Europa 3 : 18, pl. 56, figs. 342-343. Type locality : "Corsica". Seven other available names erected but not relevant here.

DISTRIBUTION : North Africa, Iberian Peninsula, Balearic Isles, south France, Corsica, Italy, Sicily.

GENITALIA : ♂ figured in STERNECK (1940 : pl. 27, fig. 456 as *isabellaria*, eighth sternite), in AGENJO (1952 : pl. 21, fig. 3, complete), ♀ figured in AGENJO (1952 : pl. 19, fig. 9, complete but ostium not visible).

MATERIAL AVAILABLE : 2 ♂♂, Balearic Isles : Ibiza ; 1 ♂, Spain : Andalusia. All in coll. v. MENTZER.

Glossotrophia confinaria (H.-S.)
Figs. 3, 7, 10.

Acidalia confinaria HERRICH-SCHÄFFER [1847], ibid. 3 : 21, pl. 51, figs. 315-316. Type locality : "Ungarn" (probably that part which is now in Rumania). Five other available names erected but not relevant here.

DISTRIBUTION : South France, Corsica, Italy, Sicily, Switzerland, Yugoslavia, Rumania, Bulgaria, Greece ; no reliable record from the Iberian Peninsula or from Hungary.

GENITALIA : ♂ figured in STERNECK (1940 : pl. 27, fig. 466, eighth sternite, dorsal view). The male genitalia figured in DE LAEVER (1966 : 51) as *G. confinaria* belong to *G. annae* sp. n.

MATERIAL AVAILABLE : 10 ♂♂ 17 ♀♀, Corsica, Italy, Yugoslavia, Greece. All in coll. v. MENTZER.

Glossotrophia rufomixtaria (GRASL.)
Figs. 4, 6, 9.

Acidalia falsaria HERRICH-SCHÄFFER [1852] partim, Systematische Bearbeitung der Schmetterlinge von Europa 6 : 68 ; pl. 76, [1851], fig. 464 ♀ as *falsaria* (not binominal). Type locality : [Spain : Andalusia :] "Ronda". – Junior primary homonym of *Acidalia falsaria* HERRICH-SCHÄFFER [1852] partim, ibid. 6 : 68 ; pl. 76, [1851], fig. 463 ♂ as *falsaria* (not binominal, nomen dubium). Type locality : [Russia :] "Elisabethpol".

Acidalia rufomixtaria (? *Acidalia falsaria rufomixtaria*) GRASLIN 1863, Ann. Soc. ent. Fr. (4) 3 : 357-358. Type locality : ? "France : Pyrénées Orientales : Colliour" ("reared at Collioure").

Acidalia rufomixtata STAUDINGER 1871 in STAUDINGER & WOCKE, Catalog der Lepidopteren des europäischen Faunengebietes 1 : 151, with reference to pl. 16, fig. 6 in Rambur [1866], Catalogue systématique des Lépidoptères de l'Andalousie, as *rufomixtata* (not binominal, no text). Type locality : "Andalusien ; Gallia meridionalis et centralis orientalis (Lugdunum)".

The name *Glossotrophia rufomixtaria* (GRASLIN 1863) is cited as a senior and valid synonym of G. *rufomixtata* (STAUDINGER 1871) by LERAUT (1980 : 134). The name was attributed by GRASLIN to RAMBUR, referring to a figure in RAMBUR, Cat. syst. Lép. Andalousie. As the name cannot be found in RAMBUR and GRASLIN did not specify the figure, it is only a subjective supposition that the name was meant as an emendation of *rufomixtata* RAMBUR, not cited by GRASLIN, and thus formally not available without a description. The association with *Acidalia falsaria* does not resolve the problem as this name refers to two different species. As I cannot judge the extremely short description by GRASLIN of the larva and the chrysalis, which also could correspond to other species, I use the name on the authority of LERAUT.

DISTRIBUTION : Iberian Peninsula, South France, Italy.

GENITALIA : ♂ figured in STERNECK (1940 : pl. 27, fig. 462, eighth sternite), in AGENJO (1952 : pl. 21, fig. 2, complete) ; ♀ in AGENJO (1952 : pl. 19, fig. 8, complete, but ostium worthless).

MATERIAL AVAILABLE : 1 ♂, Italy : Umbria ; 3 ♀♀, Spain : Aragón and Catalonia. All in coll. v. MENTZER.

Glossotrophia diffinaria PRT.

Glossotrophia diffinaria PROUT 1913 in SEITZ, The Macrolepidoptera of the World 1 (4) : 83, pl. 4h as *luridata*. Type locality : "Kleinasien".

DISTRIBUTION : Greece (new), Turkey, Iran.

GENITALIA : ♂ "both cerata well developed" (STERNECK 1940 : 107, not figured).

MATERIAL AVAILABLE : 1 ♀, Greece : Thermopyle Sept. 1984, leg. A. MOBERG. In coll. v. MENTZER. Dark scales arranged linearly over nearly the whole dorsal surface of the forewings. New for Europe.

Glossotrophia tripolitana TURATI

Glossotrophia tripolitana TURATI 1930, Boll. Lab. Zool. gen. agr. 23 : 110-111, pl. A, fig. 1. Type locality : "Tripolitania : Sidi Messri".

The species was not considered by STERNECK (1940-1941), probably due to the still persisting difficulties in finding material. It was at first suspected to be identical with *G. annae* sp. n. because of the mixture of white and yellowish scales, the ochreous crosslines, the brown cell-dot and the number of spurs on the hindtibiae (one in the single male, two in the females). It differs, however, from *G. annae* in having a black terminal line also ventrally, which does not occur in any European species. Furthermore, it is not stated to be irrorated with dark scales, which could hardly have been overlooked.

Acknowledgement

The material of *G. annae* sp. n. was sent to me by Mr. François Bolland, Cheratte (Belgium) for study and, if required, for description, with the correct supposition that it may belong to a new species. I thank Mr. Bolland for the confidence.

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Some ecological preferences of Rhopalocera in Southern Spain (Lepidoptera)

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Summary

Studies on the ecological preferences and distribution of Rhopalocera in several types of evergreen forest in the south of the Iberian Peninsula are reported. Two variables, aridity and tree-cover, were chosen in order to characterize the preferences of the most abundant species. A classification analysis using specific abundances was performed, from which groups of characteristic species have been determined for each vegetation-type.

Introduction

In recent years, a number of studies have been published on habitat preferences of Spanish Rhopalocera and the influence of several variables, especially landscape degradation (Viejo, 1983 ; Baz, 1986). Such studies describe the typical fauna of each selected vegetation-type and demonstrate the suitability of the use of this animal group as an indicator of environmental changes. In addition, they allow the ecological requirements of species to be defined, an aspect of primary importance in protection programmes (Heath, 1981).

The aim of the present study was to characterize some ecological preferences of the most abundant species of butterflies and skippers in the most widespread vegetation-types of the southern Iberian Peninsula.

Material and methods

The study area, the Sierra Norte, covers 4000 sq.km and is located in the south of the Iberian Peninsula in the province of Seville, between the Meseta Central and the Guadalquivir River Valley (Fig. 1). It is a mountainous region with a primarily siliceous substrate (granites, slates and conglomerates). Nearly all the geological formations in this region are Palaeozoic (Molina, 1988).

The Sierra Norte climax vegetation consists of evergreen oak (*Quercus rotundifolia* Lam.) and cork oak (*Quercus suber* L.) forests (Rivas Marti-

Fig. 1. The Iberian Peninsula with a detail of the province of Sevilla, with the Sierra Norte.

NEZ, 1985). Well-preserved forests are almost non-existent today. Human disturbance has resulted in a mosaic of shrubs, grassland and climax remains.

The study is based on 240 samples obtained by visual census and captures from 1985 to 1988. The method is quite similar to that employed by POLLARD (1977). At each site a fixed route of approximately 500 meters in length was used for counts and captures (the last in order to reduce errors of identification). The recorder walked at a moderate pace and recorded all butterflies and skippers seen, taking about 1 hour for each route. Recording took place between 08.00 and 16.00 hours from February until the end of November provided that weather conditions met specified minimum criteria (POLLARD, *op. cit.*).

The total number of individuals recorded was 9151, belonging to 66 species (MOLINA, *op. cit.*), but only species seen in more than 20 individuals were taken into consideration.

All localities sampled (Table 1) were grouped according to their structural complexity into four vegetation-types : scrub, scrub/tree-covered, grass/tree-covered and hedgerows/riversides. Two variables were also considered (aridity and tree-cover) for seven localities visited every week (labelled * in Table 1). The localities were selected to represent 7 grades of aridity and 6 of tree-cover (for the latter variable, data from Ribera de Huésnar, where there is no successional stage of the evergreen forest, were omitted).

For the characterization of species preferences in relation to these two variables, two indices were applied : niche breadth (B) and baricenter (g), the expressions of which are :

$$B = \frac{1}{\sum_{i}^{m} p_i^2}$$

where pi is the proportion of specimens of i species at each locality representing a grade of aridity or tree-cover. This index gives an indication of the variety of biotopes one species can exploit (BAZ, *op. cit.* ; SOUTHWOOD, 1978).

$$g = x_1 + 2*x_2 + 3*x_3 + \ldots\ldots\ldots\ldots\ldots n*x_n \,/\, \sum_{i}^{m} x_i$$

where x_1, x_2, x_3, ... x_n are the abundances of species in each grade. The expression enables one to fix the gravity centre of the abundance distribution of each species through the grades of each variable (BAZ, *op. cit.* ; DAGET, 1977).

Table 1. Localities visited. Those used to calculate niche breadth (B) and baricenter (g) are labelled *. Vegetation-types : SC = Scrub, SC/TC = Scrub/Tree-covered, GR/TC = Grass/Tree-covered, HD/RV = Hedgerows and riversides (see text).

Localities	Coordinates U.T.M.	Vegetation-type			
		SC	SC/TC	GR/TC	HD/RV
La Aulaga	29SQB2874	×			
Rio Guadiamar	29SQB3776			×	
* La Pajosa	29SQB3976	×			
La Navarra	29SQB3876		×		
* La Minilla	29SQB4973	×			
Lagos Serrano	29SQB5477	×			
El Calvario	29SQB5695		×		
Almadén Plata	29SQB5997		×		
Pto. Quejigo	29SQC6106		×		
* La Amoladera	30STH5618			×	
Repetidor TV	30STH5817			×	
* La Legua	30STH5917			×	
Valcinto	30STH6510	×			
El Pintado	30STH4707				×
* El Martinete	30STH6509		×		
* Ribera Huésnar	30STH6508				×
Cerro del Hierro	30STH7207	×			
Huerta Abajo	30STH8203			×	
* Hoya Portugués	30STH4692		×		
El Pedroso	30STH5692			×	
Constantina	30STH6896				×
El Retortillo	30STH8894			×	
Rozalejo	30STH5193	×			
Las Francas	30STH7881				×
Los Mazuecos	30STH8480			×	
Las Jarillas	30STH3776			×	
Los Melonares	30STH4678			×	
Cerro La Meona	30STH4572	×			
Arroyo Parroso	30STH5772				×
Casa Majuelo	30STH6776	×			
Barranco Hondo	30STH3568	×			
Mesa Redonda	30STH4368	×			

For the typification of each vegetation-type, a classification analysis was made. The analysis was performed by computer using the SSPC/PC+ program and the dendrogram procedure. The UPGMA method was selected as the agglomeration schedule (see SNEATH and SOKAL, 1973), and the cosine as similarity coefficient, the expression of which is :

$$I_a = \frac{\sum_i^m (x_i * y_i)}{\sum_i^m (x_i^2) \; \Sigma (y_i^2)}$$

where x_i and y_i are the abundances of species associated.

Table 2. Values of niche breadth (B) and baricenter (g) for the 44 most abundant species of the Sierra Norte. Variables are denoted ar (aridity) and tc (tree-cover).

N	Species	Bar	Gar	Btc	Gtc
1	*Syrichtus proto* (Ochsenheimer, 1808)	3.4	3.0	3.3	3.1
2	*Thymelicus flavus* (Brünnich, 1763)	4.1	4.7	3.1	4.0
3	*Spialia sertorius* (Hoffmansegg, 1804)	4.5	2.3	2.9	3.5
4	*Thymelicus actaeon* (Rottemburg, 1775)	4.8	2.9	4.3	2.9
5	*Tomares ballus* (Fabricius, 1787)	1.1	5.8	1.1	5.9
6	*Laeosopis roboris* (Esper, 1793)	1.1	6.9	1.8	5.3
7	*Celastrina argiolus* (Linnaeus, 1758)	1.3	6.5	3.0	3.7
8	*Pseudophilotes abencerragus* (Pierret, 1837)	1.8	3.1	1.7	2.4
9	*Lampides boeticus* (Linnaeus, 1767)	2.2	2.3	2.1	1.8
10	*Callophrys rubi* (Linnaeus, 1758)	2.2	3.7	2.1	4.1
11	*Glaucopsyche melanops* (Boisduval, 1828)	2.3	4.7	2.3	4.1
12	*Syntarucus pirithous* (Linnaeus, 1767)	3.1	2.7	2.8	2.2
13	*Quercusia quercus* (Linnaeus, 1758)	3.2	4.4	3.1	4.1
14	*Satyrium esculi* (Huebner, 1804)	3.5	4.4	3.2	4.1
15	*Polyommatus icarus* (Rottemburg, 1775)	3.7	4.9	3.1	4.4
16	*Aricia cramera* (Eschscholtz, 1821)	3.9	4.3	3.8	4.1
17	*Lycaena phlaeas* (Linnaeus, 1758)	5.1	4.0	4.9	4.0
18	*Pararge aegeria* (Linnaeus, 1758)	1.0	6.9	2.0	4.0
19	*Melitaea phoebe* (Denis & Schiffermueller, 1775)	1.1	3.2	1.2	3.0
20	*Polygonia c-album* (Linnaeus, 1758)	1.1	6.7	1.7	3.9
21	*Coenonympha dorus* (Esper, 1782)	1.5	2.2	1.5	1.6
22	*Pyronia bathseba* (Fabricius, 1793)	2.1	1.6	2.1	2.1
23	*Pyronia cecilia* (Vallantin, 1894)	2.1	2.0	2.1	1.7
24	*Hyponephele lupina* (Costa, 1836)	2.5	3.6	2.5	4.0
25	*Brintesia circe* (Fabricius, 1775)	2.6	4.1	2.4	3.9
26	*Hipparchia statilinus* (Hufnagel, 1766)	2.9	2.8	2.8	2.8
27	*Pyronia tithonus* (Linnaeus, 1771)	3.1	4.4	2.3	4.8
28	*Pandoriana pandora* (Denis & Schiffermueller, 1775)	3.2	5.4	2.4	3.9
29	*Vanessa cardui* (Linnaeus, 1758)	3.3	3.8	3.1	3.6
30	*Coenonympha pamphilus* (Linnaeus, 1758)	3.8	3.6	3.7	3.9
31	*Melanargia ines* (Hoffmannsegg, 1804)	4.0	2.8	4.0	2.9
32	*Maniola jurtina* (Linnaeus, 1758)	5.5	3.3	5.1	3.5
33	*Lasiommata megera* (Linnaeus, 1767)	5.5	3.5	4.6	3.2
34	*Gonepteryx rhamni* (Linnaeus, 1758)	1.3	6.7	1.2	4.2
35	*Pieris rapae* (Linnaeus, 1758)	2.4	5.8	4.7	4.1
36	*Leptidea sinapis* (Linnaeus, 1758)	2.5	4.6	2.1	5.0
37	*Anthocharis belia* (Linnaeus, 1767)	2.7	2.9	2.9	2.7
38	*Pontia daplidice* (Linnaeus, 1758)	3.0	4.1	2.9	3.6
39	*Pieris brassicae* (Linnaeus, 1758)	3.3	5.1	3.5	3.0
40	*Euchloe belemia* (Esper, 1799)	3.7	3.1	3.5	3.5
41	*Euchloe ausonia* (Huebner, 1804)	4.0	2.8	3.7	2.9
42	*Gonepteryx cleopatra* (Linnaeus, 1767)	4.3	5.3	3.4	4.6
43	*Colias croceus* (Geoffroy, 1785)	4.8	3.5	4.0	3.6
44	*Zerynthia rumina* (Linnaeus, 1758)	5.2	4.0	4.3	3.8

Results and discussion

1. Aridity

The results obtained for this variable (Table 2) allow one to deduce several groups of species (Fig. 2). Although in most cases the species are included in an intermediate zone, we have a hygrophilous group formed by : *Celastrina argiolus* (no. 7), *Laeosopis roboris* (no. 6), *Polygonia c-album* (no. 20), *Pararge aegeria* (no. 18), *Gonepteryx rhamni* (no. 34) and *Tomares ballus* (no. 5). All these are species of natural and artificial wet meadows, hedgerows and riversides, sites where they would find optimal conditions for larval development because of the occurrence of either hostplants or biotic conditions that permit an optimal growth of their preimaginal stages (this may be the case of septentrional species at the edge of their range).

At the opposite extreme, we have *Coenonympha dorus* (no. 21), *Pyronia bathseba* (no. 22), *Pyronia cecilia* (no. 23) and *Lampides boeticus* (no. 9) that characterize the driest localities and represent some of the most xerothermophilous Rhopalocera of the region.

Within the specialists (low B), *Melitaea phoebe* (no. 19) and *Pseudophilotes abencerragus* (no. 8) form a set of species that appear to be indifferent to humidity, and their presence in certain biotopes may be due to other factors, such as the occurrence of a particular hostplant.

With intermediate values of both B and g, *Spialia sertorius* (no. 3) exhibits a marked tendency toward dry areas, whereas *Pandoriana pandora* (no. 28), *Pieris brassicae* (no. 39), *Gonepteryx cleopatra* (no. 42), *Polyommatus icarus* (no. 15) and *Thymelicus flavus* (no. 2), typical aestival species, show some preferences for wet places. In the latter cases, however, local movements may occur in response to the need for finding new areas with a more adequate microclimate.

Finally, a set of species showing wide preferences (high B values) can be separated in the region. *Lasiommata megera* (no. 33), *Maniola jurtina* (no. 32), *Colias croceus* (no. 43), *Zerynthia rumina* (no. 44), *Lycaena phlaeas* (no. 17) or *Thymelicus actaeon* (no. 4). All these species are characteristic of "monte bajo" (mediterranean scrub) and "encinar" (evergreen oak forest) in the Iberian Peninsula (see also Viejo, *op. cit.*).

2. Tree-cover

This variable defines different groups of species (Table 2, Fig. 3). Although segregation is more confused, *Pyronia bathseba* (no. 22), *Pyronia cecilia* (no. 23), *Lampides boeticus* (no. 9), *Syntarucus pirithous* (no. 12), *Pseudophilotes abencerragus* (no. 8) and *Coenonympha dorus* (no. 21) can be

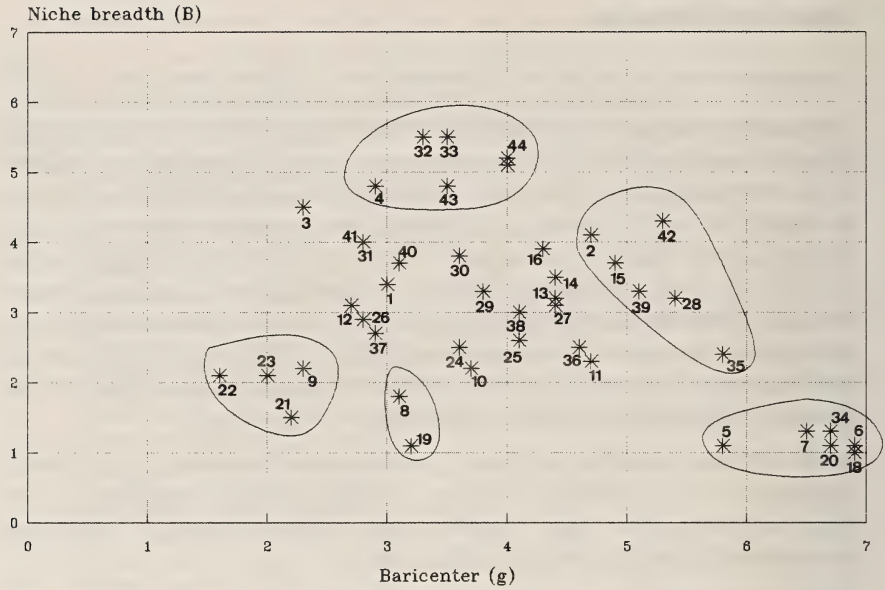

Fig. 2. Species grouped according to their values of B and g for aridity. Numbers as in table 2.

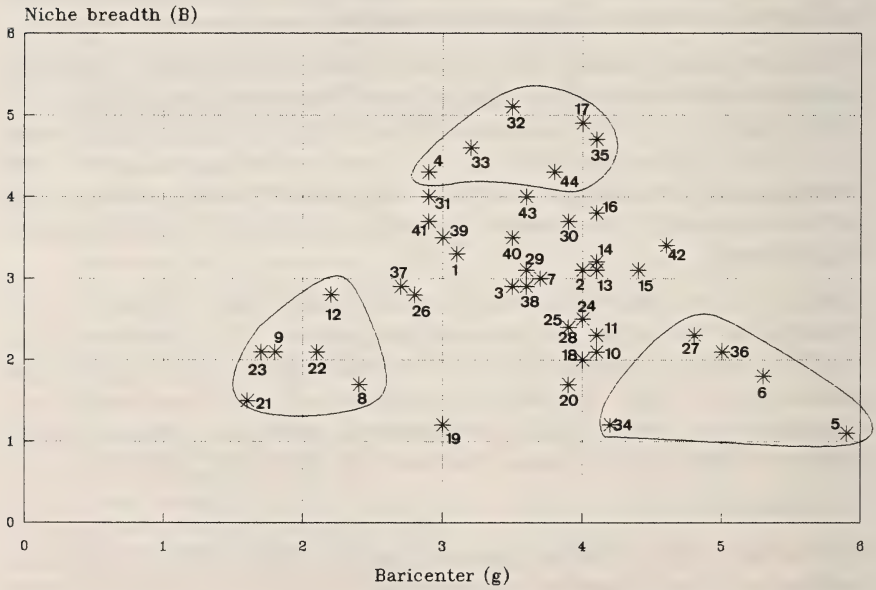

Fig. 3. Species grouped according to their values of B and g for tree-cover. Numbers as in table 2.

separated as species from scrub or areas with scarce tree-cover. These species feed on herbaceous plants or shrubs of the evergreen forest undergrowth and are thermophilous.

As with the previous variable, a wide group of indifferent species are also found (intermediate B and g values) with *Thymelicus actaeon* (no. 4), *Lycaena phlaeas* (no. 17), *Maniola jurtina* (no. 32), *Lasiommata megera* (no. 33), *Pieris rapae* (no. 35), *Colias croceus* (no. 43) and *Zerynthia rumina* (no. 44) as the taxa with minimal preferences on this variable.

Finally, *Pyronia tithonus* (no. 27), *Leptidea sinapis* (no. 36), *Laeosopis roboris* (no. 6), *Tomares ballus* (no. 5) and *Gonepteryx rhamni* (no. 34) prefer areas with developed tree-cover.

3. Cluster analysis

Cluster analysis (Table 3, Fig. 4) of these results allows one to define each vegetation-type in the study area as follows :

– The areas with thermophilous scrub are typified by the presence and abundance of *Pyronia bathseba* (no. 22), *Pyronia cecilia* (no. 23), *Coenonympha dorus* (no. 21), *Lampides boeticus* (no. 9) and *Syntarucus pirithous* (no. 12). In the dendrogram these species appear closely linked with *Pseudophilotes abencerragus* (no. 8), *Anthocharis belia* (no. 37), *Hipparchia statilinus* (no. 26) and *Euchloe ausonia* (no. 41), which are also observed in woodland areas with a damper climate.

– *Melanargia ines* (no. 31), *Euchloe belemia* (no. 40) and *Zerynthia rumina* (no. 44) are characteristic of open places, with few bushes, irrespective of the degree of tree-cover. These taxa are widely distributed in the region. *Melitaea phoebe* (no. 19) and *Pontia daplidice* (no. 38) appear as typical intermediate species between grass/tree-covered and woodland areas.

– *Tomares ballus* (no. 5) and *Leptidea sinapis* (no. 36) are the most specialized species, since they are found in areas with some structural complexity (scrub/tree-covered, high scrub) and a temperate climate. They characterize the most preserved areas in the region.

– *Lasiommata megera* (no. 33), *Maniola jurtina* (no. 32), *Spialia sertorius* (no. 3), *Colias croceus* (no. 43), *Thymelicus actaeon* (no. 4), *Coenonympha pamphilus* (no. 30) and *Callophrys rubi* (no. 10) show preferences between scrub and scrub/tree-cover, being always more abundant in dry areas.

– Hedgerows and riversides show a very similar fauna. *Pandoriana pandora* (no. 28), *Pieris brassicae* (no. 39), *Pieris rapae* (no. 35), *Pyronia tithonus* (no. 27), *Pararge aegeria* (no. 18), *Polygonia c-album* (no. 20)), *Laeosopis roboris* (no. 6) and *Celastrina argiolus* (no. 7) are common species in these habitats showing some preferences for tree-cover.

Table 3. Average abundances of species at each vegetation-type (all localities included) used for cluster analysis. Abbreviations as in table 1. Species are named with the first letter of their genus and three first letters of specific name. Numbers correspond with those of table 2 and figs 2 and 3.

N	Species	Vegetation-types			
		SC/TC	SC	GR/TC	HD/RV
1	SPRO	27.70	17.00	27.30	4.30
2	TFLA	1.70	4.50	5.25	7.30
3	SSER	2.70	2.20	1.25	1.70
4	TACT	18.30	5.17	8.75	3.30
5	TBAL	5.00	0.00	0.50	0.00
6	LROB	0.66	0.00	0.25	21.70
7	CARG	0.67	1.00	1.00	37.00
8	PABE	11.70	40.30	0.25	0.00
9	LBOE	3.70	55.00	3.00	2.70
10	CRUB	6.50	5.00	0.00	0.33
11	PICA	5.33	1.30	6.50	2.67
12	SPIR	5.83	43.30	2.75	4.00
13	QQUE	33.80	0.00	71.00	2.30
14	SESC	25.00	1.00	38.00	6.30
15	GMEL	4.30	2.33	8.50	0.00
16	ACRA	37.70	12.00	80.30	4.70
17	LPHL	41.90	30.60	43.70	7.33
18	PAEG	0.33	0.33	0.00	94.00
19	MPHO	0.00	0.00	15.25	0.33
20	PCAL	0.33	0.00	0.50	2.16
21	CDOR	1.33	20.00	0.00	0.00
22	PBAT	2.00	79.00	7.00	0.00
23	PCEC	15.00	230.70	5.25	1.25
27	PTIT	14.50	0.00	7.00	11.00
25	BCIR	5.17	0.00	9.25	1.30
24	HLUP	16.50	8.30	20.25	0.00
26	HSTA	5.50	14.30	3.00	0.00
28	PPAN	1.33	0.34	6.34	9.31
29	VCAR	1.50	1.01	5.79	0.63
30	CPAM	132.17	88.30	52.50	11.70
31	MINE	4.20	19.30	14.25	0.00
32	MJUR	81.80	127.30	62.00	22.00
33	LMEG	1.70	3.70	1.00	1.00
34	GRHA	0.17	0.00	1.00	15.70
35	PRAP	12.84	9.00	11.00	99.30
36	LSIN	12.50	1.30	0.00	2.67
37	ABEL	1.17	3.70	0.25	0.50
38	PDAP	3.30	3.70	16.00	1.00
39	PBRA	0.17	1.70	4.00	10.00
40	EBEL	0.67	3.30	2.25	0.00
41	EAUS	4.30	17.00	5.25	0.00
42	GCLE	4.50	0.33	3.00	7.67
43	CCRO	10.83	14.70	7.00	7.33
44	ZRUM	1.33	8.30	4.75	2.67

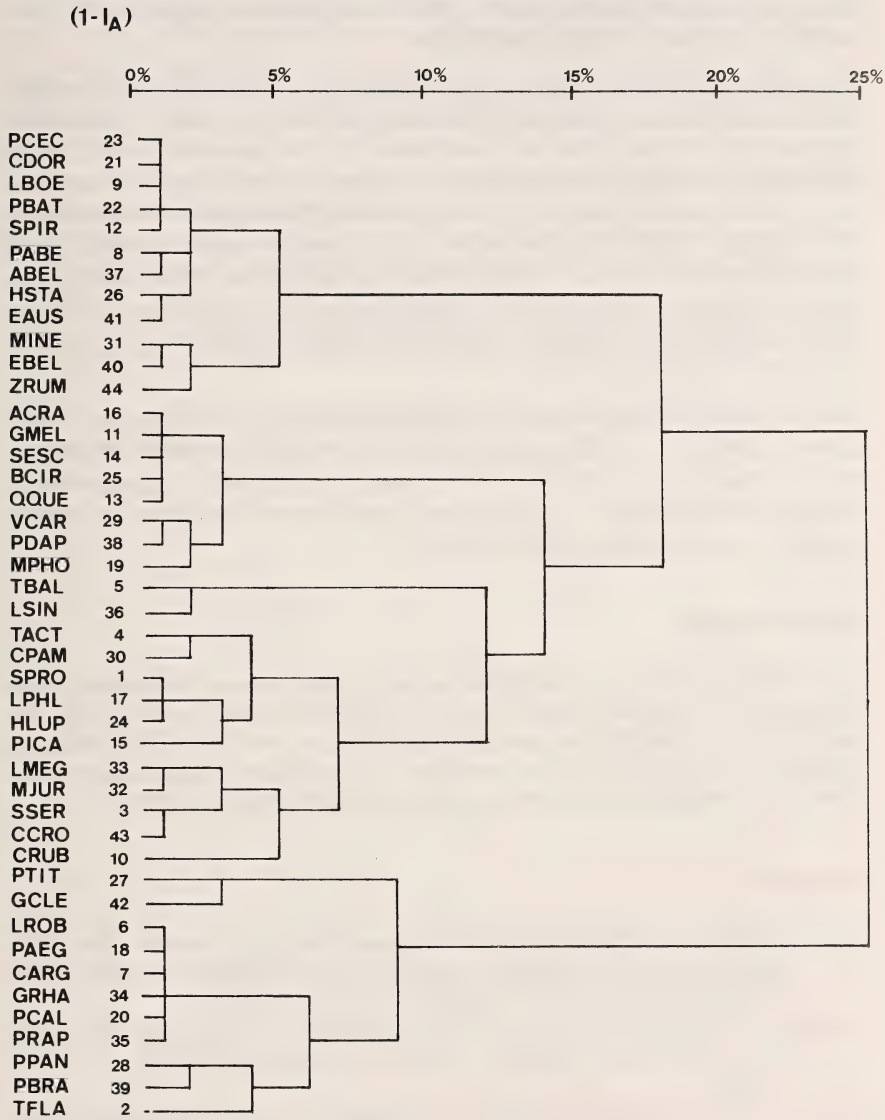

Fig. 4. Dendrogram obtained by cluster analysis of the specific abundances in the four vegetation-types. Species abbreviations and numbers as in table 3.

These results are similar to those obtained by GARCIA-BARROS (1982), VIEJO (*op. cit.*) and BAZ (*op. cit.*) concerning the two variables considered here. Minor differences may be due to other subspecies or adaptations of the species at the limit of their distribution.

The analysis of variables taken into consideration independently, does not seem to adequately explain the habitat selection by species. The spatial distribution of adults can be determined by the presence of the larval foodplant or nectar-sources. However, the results must be carefully analyzed and possible annual changes in this spatial distribution cannot be excluded. Such changes would be due to the typical mediterranean irregularity of resources and the associated interspecific competition that would result in the spatial or temporal segregation of related species. This may be so in the case of the genus *Pyronia* (VIEJO, 1982) or the Pierinae species (VIEJO, *op. cit.* ; COURTNEY and CHEW, 1987).

Thus, if the floral composition and distribution of an area is known, some general aspects of its Rhopalocera fauna can be predetermined. However, more studies on this subject are necessary (principally in geographical variations of preferences) to determine general trends useful for evaluation projects or management of natural areas.

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The genus *Acalyptris* MEYRICK (Lepidoptera, Nepticulidae) in the USSR : Distribution and taxonomy

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Summary

Fourteen species of the leaf-mining genus *Acalyptris* MEYRICK occurring in the USSR are reviewed. The species fall into two species groups. *Acalyptris piculus* sp. n., *A. brevis* sp. n. and *A. egidijui* sp. n. are described. *A. turanicus* (PUPL.) is synonymized with *A. lvovskyi* (PUPL.). A key to the species, short diagnoses and figures of all the *Acalyptris* species occurring in the Soviet Union are given.

Zusammenfassung

Es werden 14 Arten der blattminierender Gattung *Acalyptris* MEYRICK (Lepidoptera, Nepticulidae) untersucht. Sie werden in 2 Arten-Gruppen aufgeteilt. Neu beschrieben wird *Acalyptris piculus* sp. n., *A. brevis* sp. n. und *A. egidijui* sp. n. *A. turanicus* (PUPL.) wird mit *A. lvovskyi* (PUPL.) synonymisiert. Eine Schlüsseltabelle, Kurzdiagnosen und Abbildungen aller Arten der Gattung *Acalyptris* in der UdSSR werden beigelegt.

Introduction

In the USSR the genus *Acalyptris* occurs only in the southern deserts and dry mountainous areas. The first scanty data on this genus from the USSR was obtained from material collected by V. I. KUZNETZOV in 1952 from the Western Kopet-Dag mountains, by PASTUCHOV in 1965, from Uzbekistan and by V. KRIVOCHATSKYI in 1981-82 from the northern part of the Kara-Kum desert. However, a more extensive and excellent material has been received recently from expeditions undertaken in 1965-1983 by M. I. FALKOVITSH in various localities of the Kizilkum and Karakum deserts as well as the Kuldzhunktau mountains. On the basis of this material, and the collections of A. L. LVOVSKYI and I. M. KERZHNER from Mongolia in 1980-1981, the first review of the species of the genus *Acalyptris* from the deserts of Mongolia and the USSR was presented, including the description of 10 new species (PUPLESIS, 1984). A further two new species were described later (FALKO-

VITSH, 1986). However, this was followed by several specially equipped expeditions to largely unexplored and unknown areas in Soviet Central Asia. The considerable material collected on these expeditions should provide more data on the genus *Acalyptris* and thereby provide a better basis for future taxonomic revisions. The type material of all species described in the genus *Acalyptris* from the USSR is deposited in the collection of the Zoological Institute of the USSR Academy of Sciences (Leningrad).

Acalyptris MEYRICK

Acalyptris MEYRICK, 1921 : 385-416.
Type-species : *A. psammophricta* MEYRICK, 1921.

The western Palaearctic-southern African genus *Niepeltia* STRAND, 1934 and the Nearctic genus *Microcalyptris* BRAUN, 1925 were synonymized in the absence of clear differences in genital and adult morphology by PUPLESIS (1984 : 486-487). The genus *Acalyptris* MEYRICK, 1921 was described on the basis of a single female specimen. After careful reexamination of this specimen, the genera *Niepeltia* and *Microcalyptris* were finally synonymized with *Acalyptris* by VAN NIEUKERKEN (1986). About 47 species of this genus are known. The larval foodplants of all USSR species are unknown. Other species of the genus are known to feed on Anacardiaceae, Capparaceae, Combretaceae, Cyperaceae, Euphorbiaceae, Fabaceae, Limoniaceae, Loranthaceae, Lythraceae, Myrtaceae, Platanaceae, Rhamnaceae, Rhizophoraceae, Rubiaceae, Rutaceae and Theaceae (VAN NIEUKERKEN, 1986). All species share the typical venation, with the closed cell shifted towards the base and the $R_s + M$ almost straight. In the male genitalia, lateral apophyses are present and the transverse bar of the transtilla is absent in the majority of species. *Acalyptris* species are generally pale, usually unicolorous creamy or brownish, only sometimes is some pattern present on the forewings.

A full description of the genus was presented by PUPLESIS (1984) and VAN NIEUKERKEN (1986).

The original descriptions of all species treated here (except *A. piculus* sp. n., *A. brevis* sp. n. and *A. egidijui* sp. n.) were published in Russian.

Key to the species of the genus *Acalyptris* occurring in the USSR

1. Forewing with distinct non-interrupted fuscous longitudinal stripe (fig. 1) . . . . . *vittatus*
- Forewing without distinct non-interrupted fuscous longitudinal stripe 2
2. Uncus in form of broad lobe without ventral tooth (figs. 4, 7). Lateral apodemes in male genitalia present (fig. 4). Pectinifer on valvae may be

present (figs. 4, 10, 13) ; large characteristic tufts of androconial scales on abdomen often present (figs. 3, 6, 9) . . . (*repeteki* group) 3

- Uncus in form of inverse "v" with sharp ventral tooth (figs. 23, 26). Lateral apodemes in male genitalia absent. Pectinifers on valvae absent ; tufts of androconial scales on abdomen absent or obsolete . . . . . (*shafirkanus* group) 9

3. Abdomen of male with large tufts of androconial scales on tergites 4
- Abdomen without tufts of androconial scales 7
4. Central element of gnathos narrow and with pointed tip 5
- Central element of gnathos more or less broad and with rounded or truncate tip 6
5. Tufts of androconial scales fuscous or ochreous-brown ; clear triangular ochreous-brown sclerotizations present on abdominal tergites (fig. 5) . . . . . *arenosus*
- Tufts of androconial scales creamy or pale brownish ; triangular ochreous-brown sclerotizations, on abdominal tergites absent . . . . . *falkovitshi*
6. Gnathos caudally truncated, uncus slightly narrowed caudally, pectinifer very distinct and always strongly isolated (fig. 13) . . . . . *lvovskyi* (= *turanicus* syn. n.)
- Gnathos not caudally truncate, uncus trapezoid, pectinifer on valvae not distinct and not strongly isolated (fig. 7) . . . . . *pallens*
7. Forewings with distinct fuscous pattern (fig. 15). Gnathos not sharply tapering, but cut off apically . . . . . *turcomanicus*
- Forewings without distinct pattern. Gnathos sharply tapering apically 8
8. Valvae relatively short, slightly tapering apically (fig. 18) . . . . *galinae*
- Valvae long and narrow, slightly broader apically (fig. 20) . . *repeteki*
9. Valvae with distinct inner lobe (or lobes) basally or apically 10
- Valvae without lobes, narrower apically 12
10. Pseuduncus without distinct lateral lobes 11
- Pseuduncus with two large lateral lobes . . . . . *egidijui* sp. n.
11. Aedeagus with 3 wide apical lobes, vinculum very wide anteriorly . . . . . *shafirkanus*
- Aedeagus without wide apical lobes, vinculum slightly narrowed anteriorly . . . . . *desertellus*
12. Aedeagus strongly and abruptly narrowed basally . . . . . *piculus* sp. n.
- Aedeagus not narrowed basally 13
13. Arms of transtilla more or less triangular, not narrowed abruptly . . . . . *kizilkumi*
- Arms of transtilla abruptly narrowed anteriorly . . . . . *brevis* sp. n.

Checklist of USSR species of the genus *Acalyptris* MEYRICK

The *repeteki* group

1. *A. vittatus* (PUPLESIS, 1984)
2. *A. arenosus* (FALKOVITSH, 1986)
3. *A. pallens* (PUPLESIS, 1984)
4. *A. falkovitshi* (PUPLESIS, 1984)
5. *A. lvovskyi* (PUPLESIS, 1984)
   = *Microcalyptris turanicus* PUPLESIS, 1984 (syn. n.)
6. *A. turcomanicus* (PUPLESIS, 1984)
7. *A. galinae* (PUPLESIS, 1984)
8. *A. repeteki* (PUPLESIS, 1984)

The *shafirkanus* group

9. *A. shafirkanus* (PUPLESIS, 1984)
10. *A. desertellus* (PUPLESIS, 1984)
11. *A. piculus* sp. n.
12. *A. kizilkumi* (FALKOVITSH, 1986)
13. *A. brevis* sp. n.
14. *A. egidijui* sp. n.

The *repeteki* group

The male genitalia of the species in this group have the uncus in the form of a broad lobe, without sharp tooth ventrally. In contrast to the *shafirkanus* group, all species have a well developed pectinifer, only in two species is it weakly developed (*A. pallens, A. galinae*). Large tufts of long androconial scales are present on the male abdominal tergites of most species. The female genitalia often possess long setae. The group includes morphologically closely related species. This appears to be a typical desert group, being widely distributed in the deserts of the USSR and Mongolia. It also shows a slight morphological resemblance to some Nearctic species, such as *A. thoracealbella* CHAMBERS.

Acalyptris vittatus (PUPLESIS) (figs. 1-2, 40).

Microcalyptris vittatus PUPLESIS, 1984 : 491-492.

Male unknown.

Female characterised by a longitudinal brown stripe on the forewings (fig. 1), a large bursa copulatrix and very long setae on the abdominal tergites (fig. 2).

MATERIAL EXAMINED : 1 ♀ (holotype), Uzbekistan, Kyzylkum, Zhamansai, 22.IX.1968, M. FALKOVITSH.

Acalyptris arenosus **(FALKOVITSH)** (figs. 3-5, 40).

Microcalyptris arenosus FALKOVITSH, 1966 : 168-169.

Externally this species can be distinguished by a darker reddish-brown tuft of androconial scales (fig. 3). In the male genitalia *A. arenosus* is similar to *A. falkovitshi* and *A. lvovskyi* (fig. 4), but separated from the latter by the pointed central element of the gnathos ; from *falkovitshi* by the presence of brown triangular sclerotizations on the abdominal tergites (fig. 5) and by the slightly curved valves. Female unknown.

MATERIAL EXAMINED : 5 ♂ (1 ♂ holotype), Uzbekistan, Zhamansai, 140 km N-W Shafirkan, 10.VI.1966 ; 1 ♂, same locality, 20.V.1967 ; 1 ♂, Turkmenistan, Repetek, 11.V.1983, M. FALKOVITSH ; 4 ♂, Turkmenistan, Sandykatchi, 29.IV-3.V.1986, R. PUPLESIS.

Acalyptris pallens **(PUPLESIS)** (figs. 6-8, 38).

Microcalyptris pallens PUPLESIS, 1984 : 501.

A. pallens is characteristically a more or less pale species (fig. 6), similar to *A. galinae, A. repeteki* and some specimens of *A. lvovskyi.* It can be separated from these species by the presence of pale tufts on the abdomen (in *A. lvovskyi* the tufts are brown, in *A. galinae* and *A. repeteki* they are absent). In the male, *A. pallens* is easily recognised by a wide pseuduncus and central element of gnathos (fig. 7) ; female genitalia separated from *A. galinae* by the presence of well developed anal papillae and longer posterior apophyses (fig. 8).

MATERIAL EXAMINED : 6 ♂ (holotype and paratypes), Mongolia, Bajan-Chongor aimak, 160 km S Shine-Dzhista, 11.VII.1981, A. LVOVSKYI ; 2 ♂ (paratypes), USSR, Uzbekistan, Tamdybulak, 6.V.1965, PASTUCHOV ; 2 ♂ (paratypes), USSR, 7 km N Tamdybulak, 6.V.1965 ; 2 ♂ (paratypes), Uzbekistan, 70 km N-W Gazli, 26.V.1965 ; 1 ♂ (paratype), Uzbekistan, Ispas, 70 km N-W Chardzhou, 30.V.1965 ; 2 ♂ (paratypes), Uzbekistan, Zhamansaj, 149 km NW Shafirkan, 20.V.1967, M. FALKOVITSH ; 1 ♂, Uzbekistan, 7 km N Tamdybulak, 5.V.1965, M. FALKOVITSH ; 6 ♂, 5 ♀, Turkmenistan, Sandykatchi, 29.IV-2.V.1986, R. PUPLESIS.

Acalyptris falkovitshi **(PUPLESIS)** (figs. 9-11, 39).

Microcalyptris falkovitshi PUPLESIS, 1984 : 499.

In contrast to *A. lvovskyi*, the males are characterised by the pointed, narrower central element of the gnathos (fig. 10), the pale tufts on the abdomen, and the forewing pattern : the costal and especially the dorsal margins creamy, free of brownish scales (fig. 9). Unlike in *A. lvovskyi* and *A.*

arenosus (fig. 5) the sclerotizations on the abdominal tergites are not visible. The female genitalia are difficult to separate from those of *lvovskyi* (fig. 11), but the adults can usually be distinguished from the wing pattern.

MATERIAL EXAMINED : 13 ♂ (holotype and paratypes), Uzbekistan, 7 km N Tamdybulak, 5.V.1965, M. FALKOVITSH ; 1 ♂ (paratype), Uzbekistan, Zhamansaj, 20.V.1967, M. FALKOVITSH ; 18 ♂, 2 ♀, Turkmenistan, Sandykatchi, 29.IV-4.V.1986, R. PUPLESIS.

Acalyptris lvovskyi **(PUPLESIS)** (figs. 12-14, 38).

Microcalyptris lvovskyi PUPLESIS, 1984 : 494-495.
Microcalyptris turanicus PUPLESIS, 1984 : 497-498, **syn. n.**

Usually, unlike all other species of this group, the forewing of *A. lvovskyi* is densely covered with brown (or brownish) scales. Occasionally, the anal edge of the forewing is pale creamy. Sometimes the whole forewing is pale, weakly irrorate with numerous brownish scales (fig. 12). Easily separated from all related species (except *A. turcomanicus*) by the central element of gnathos, which is caudally indented (fig. 13). Valvae longer and slender than in *A. turcomanicus* or *A. falkovitshi.* Female genitalia similar to *A. falkovitshi,* characterised by long chaetae and elongate bursa copulatrix with signa with numerous small spines (fig. 14).

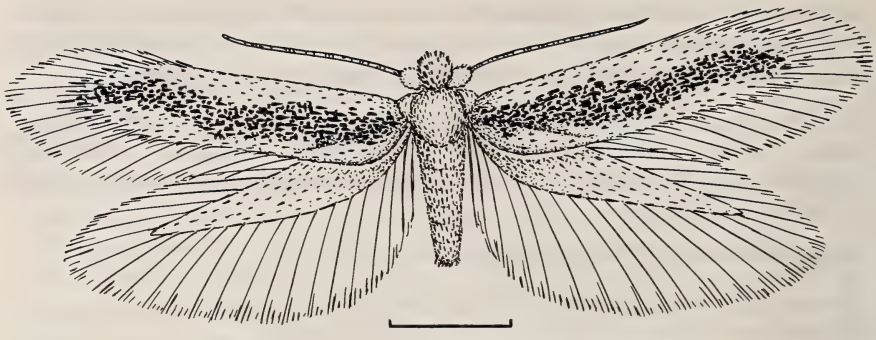
MATERIAL EXAMINED : 3 ♂ (holotype and paratypes), Mongolia, Bajan Chongor aimak, 160 km S Shine-Dzhista, 11.VIII.1981, A. LVOVSKYI ; 1 ♂ (paratype), Chovd aimak, Iolchon, 22.VI.1980, I. KERZHNER ; 4 ♂ (paratypes), USSR, Uzbekistan, 7 km N Tamdybulak, 5.V.1965 ; 3 ♂ (paratypes), Uzbekistan, 70 km N-W Gazli, 26.V.1965 ; 3 ♂ (paratypes), Uzbekistan, Zhamansaj, 12-20.V.1966 ; 1 ♂ (paratype), Bukhara Region, Shafirkan, 4.IX.1971 ; 2 ♂ (paratypes), Uzbekistan, Zhamansaj, 140 km N-W Shafirkan, 20.V.1967 ; 2 ♂ (paratypes), Turkmenistan, Repetek, 23.IV-6.V.1983, M. FALKOVITSH ; 1 ♂ (paratype), same locality, 2.VIII.1981, V. KRIVOCHTSKYI ; 1 ♂ (holotype of *M. "turanicus"*), Uzbekistan, 140 km N-W Shafirkan, 20.V.1967, M. FALKOVITSH ; 101 ♂, 17 ♀, Turkmenistan, Sandykatchi, 29.IV.-5.V.1986, R. PUPLESIS.

Acalyptris turcomanicus **(PUPLESIS)** (figs. 15-16, 40).

Microcalyptris turcomanicus PUPLESIS, 1984 : 499-500.

This species is distinguished by the absence of abdominal tufts and the patches of brown scales on the pale forewings (fig. 15) ; in the male genitalia by a characteristic form of the valvae, aedeagus and gnathos (fig. 16). The gnathos is similar to that of *A. lvovskyi* ; but *A. turcomanicus* can easily be distinguished from all other *Acalyptris* spp. by the combined characters.

MATERIAL EXAMINED : 1 ♂ (holotype), Turkmenistan, 70 km N Ashkhabad, Karakul, 27.IX.1967, M. FALKOVITSH.



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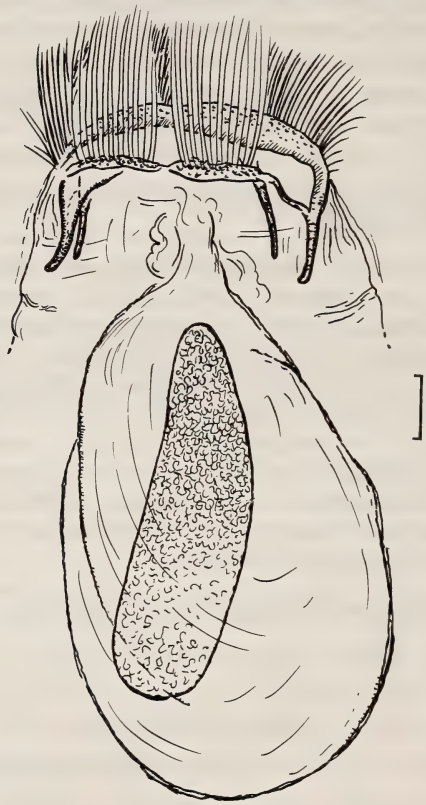
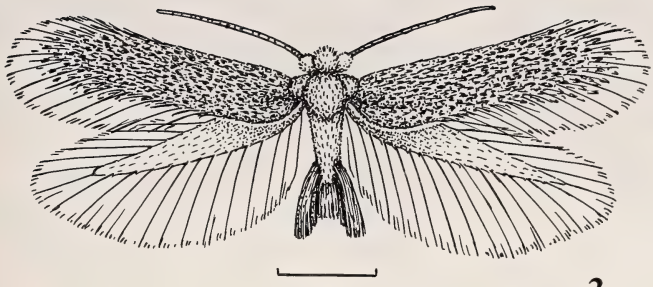


2

Figs. 1-2. *Acalyptris vittatus* (PUPL.), holotype; Uzbekistan, Kizilkum, Zhamansai, 22.IX.1986, leg. M. FALKOVITSH; 1 – imago (scale 1 mm); 2 – male genitalia (scale 0,1 mm).



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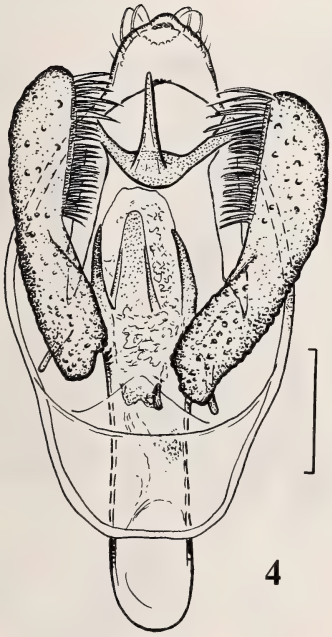

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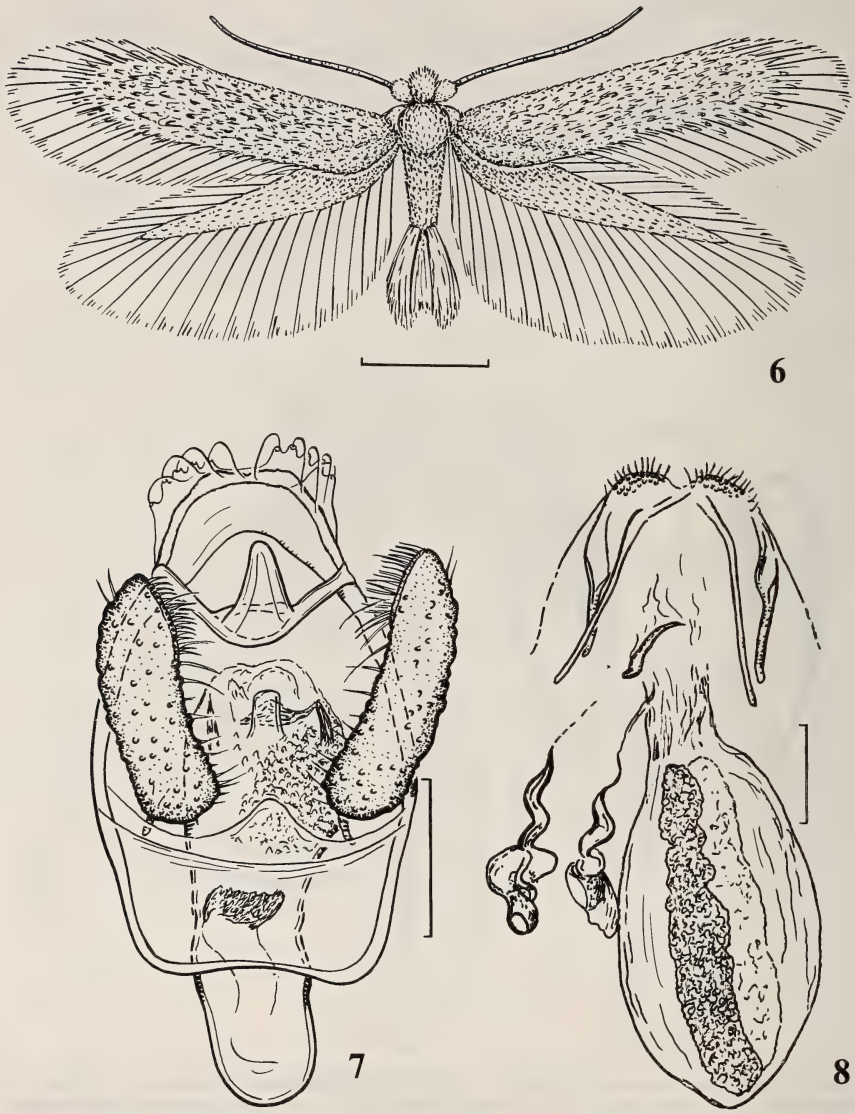
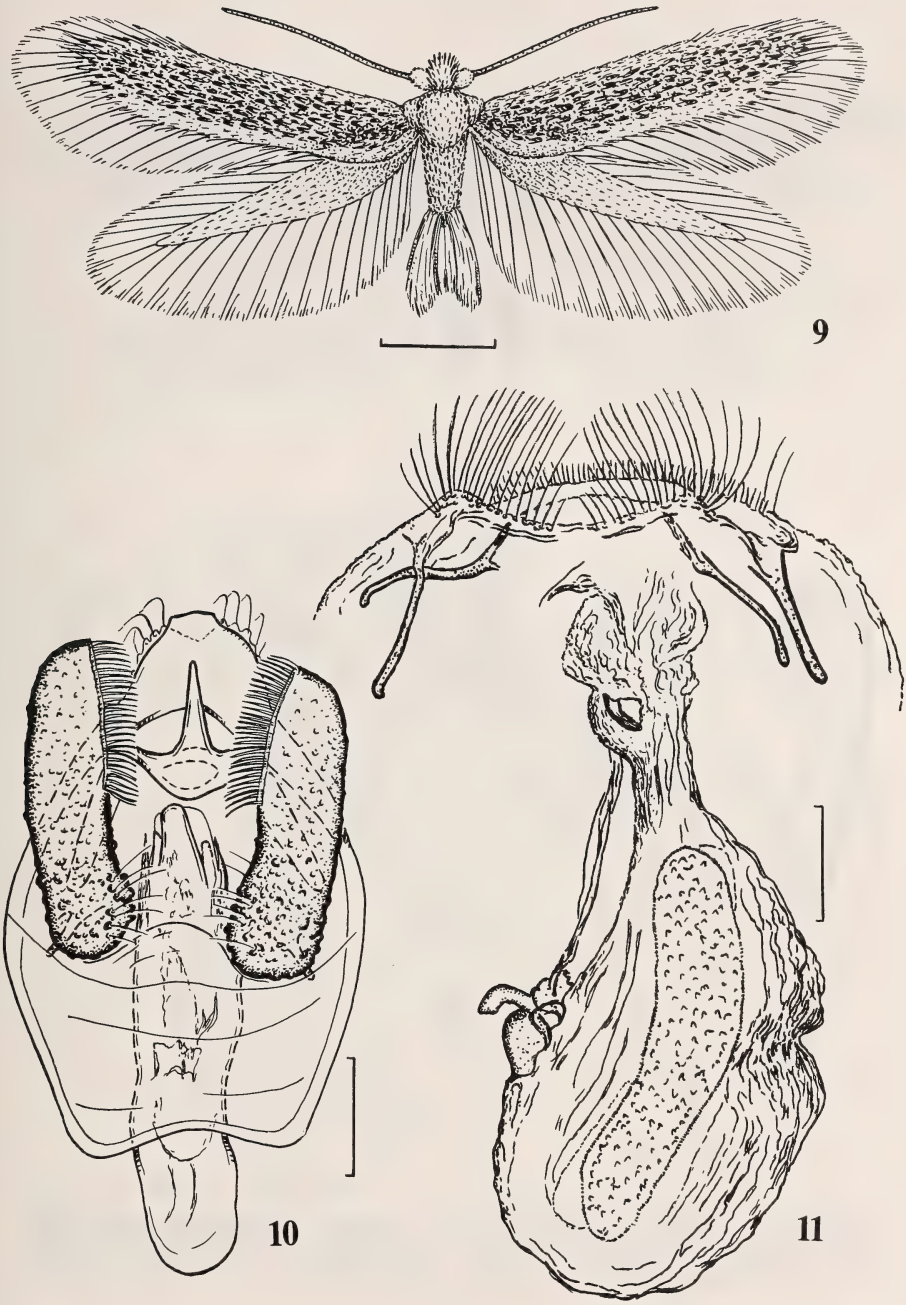
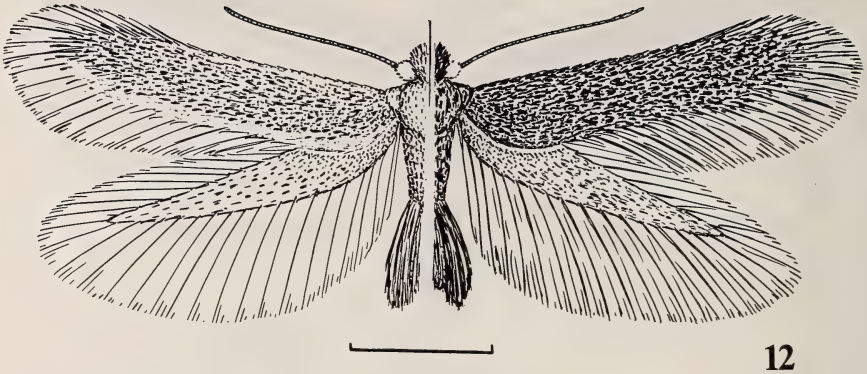
Figs. 3-5. *Acalypris arenosus* (Falk.) : 3 – holotype, Uzbekistan, Zhamansai, 140 km N-W Shafirkan, 10.VI.1966, leg. M. Falkovitsh (scale 1 mm) ; 4 – male genitalia, Turkmenistan, Sandykatchi, 1.V.1986, leg. R. Puplesis (scale 0,1 mm) ; 5 – abdominal segments, same locality, 3.V.1986, (scale 0,1 mm).



Figs. 6-8. *Acalyptris pallens* (PUPL.) : 6 – imago, Turkmenistan, Sandykatchi, 29.IV.1986, leg. R. PUPLESIS (scale 1 mm) ; 7 – male genitalia, same data (scale 0,1 mm) ; 8 – female genitalia, same locality, 2.V.1986 (scale 0,1 mm).



Figs. 9-11. *Acalyptris falkovitshi* (Pupl.) : 9 – holotype, Uzbekistan, 7 km N Tamdybulak, 5.V.1965, leg. M. Falkovitsh (scale 1 mm) ; 10 – male genitalia, Turkmenistan, Sandykatchi, 29.IV.1986, leg. R. Puplesis (scale 0,1 mm) ; 11 – female genitalia, same data (scale 0,1 mm).



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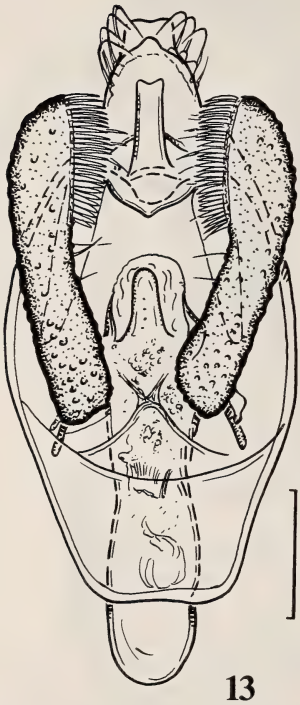

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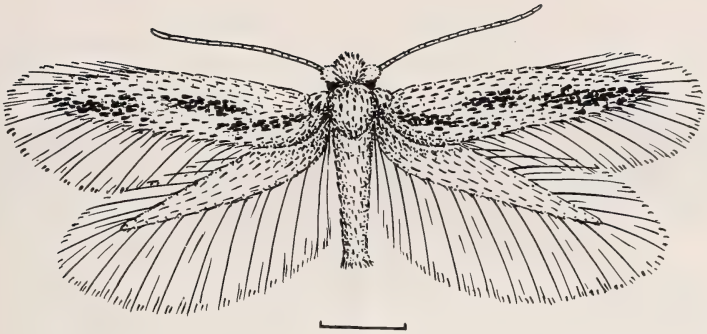
Figs. 12-14. *Acalyptris lvovskyi* (Pupl.): 12 – imago, Turkmenistan, Sandykatchi, 29.IV.1986, leg. R. Puplesis (scale 1 mm); 13 – male genitalia, same data (scale 0,1 mm); 14 – female genitalia, same locality, 1.V.1986 (scale 0,1 mm).



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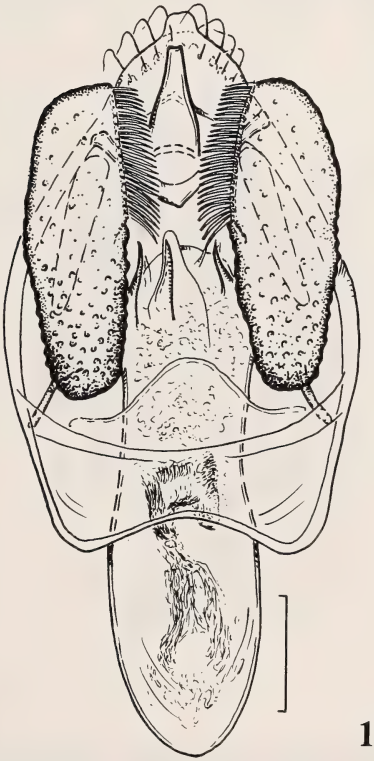
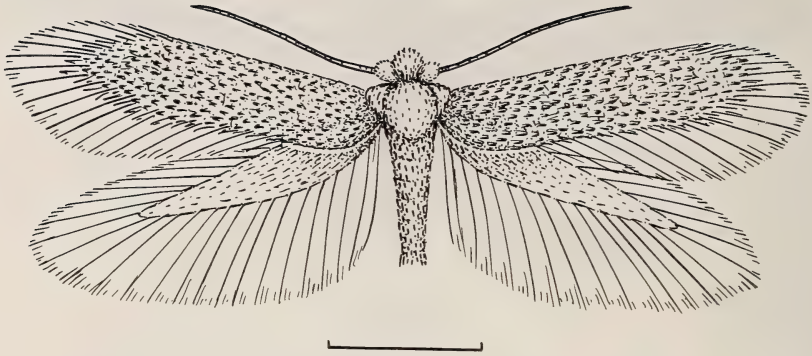


16

Figs. 15-16. *Acalyptris turcomanicus* (PUPL.) ; holotype, Turkmenistan, 70 km N Ashkhabad, Karakul, 27.X.1967, leg. M. FALKOVITSH, 15 – imago (scale 1 mm) ; 16 – male genitalia (scale 0,1 mm).



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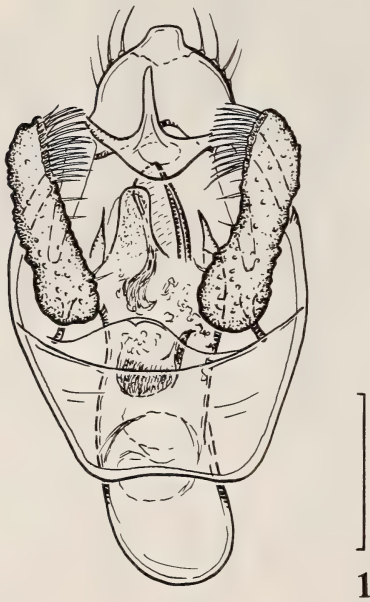
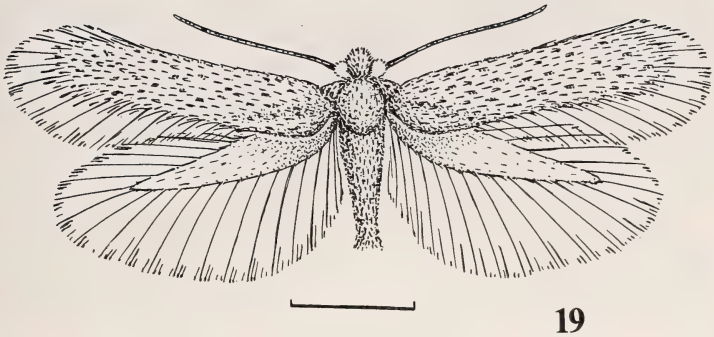


18

Figs. 17-18. *Acalyptris galinae* (Pupl.) : 17 – imago, Turkmenistan, Sandykatchi, 1.V.1986, leg. R. Puplesis (scale 1 mm) ; 18 – male genitalia, same data (scale 0,1 mm).



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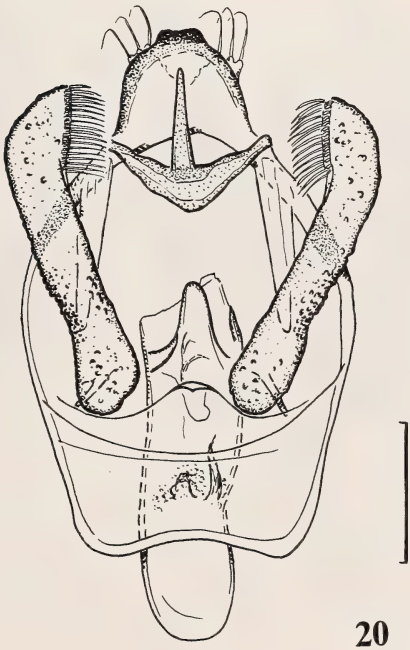
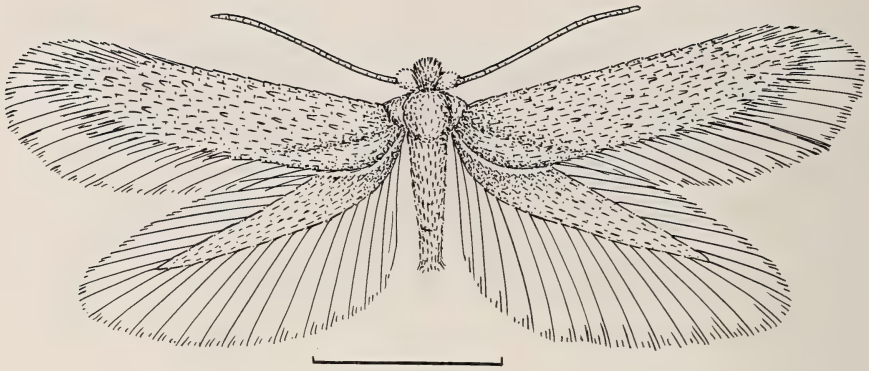


20

Figs. 19-20. *Acalyptris repeteki* (PUPL.), holotype, Turkmenistan, Repetek, 4.V.1983, leg. M. FALKOVITSH : 19 – imago (scale 1 mm) ; 20 – male genitalia (scale 0,1 mm).



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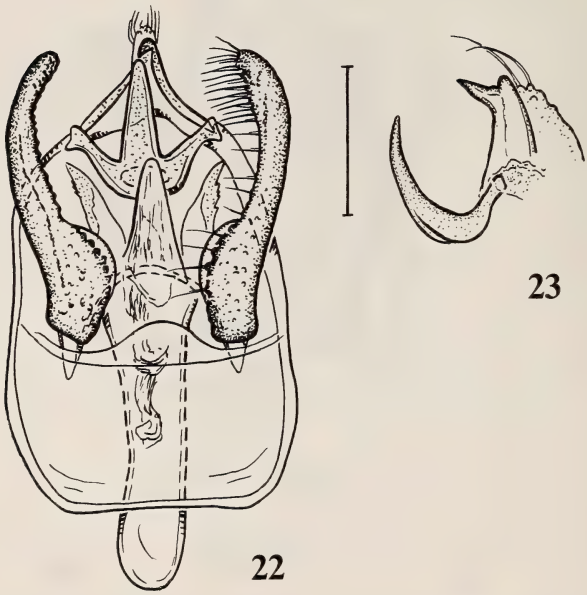

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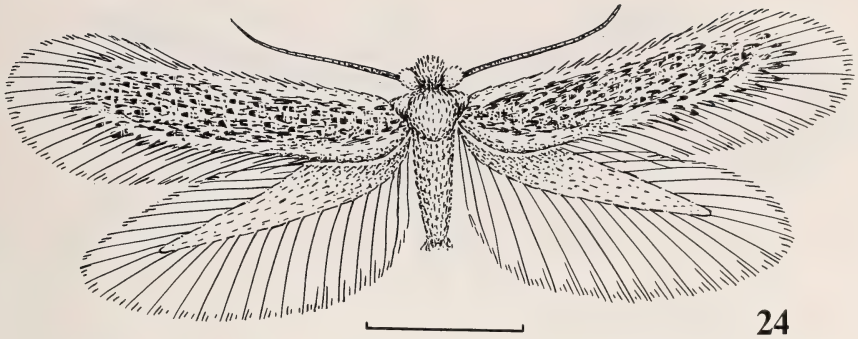
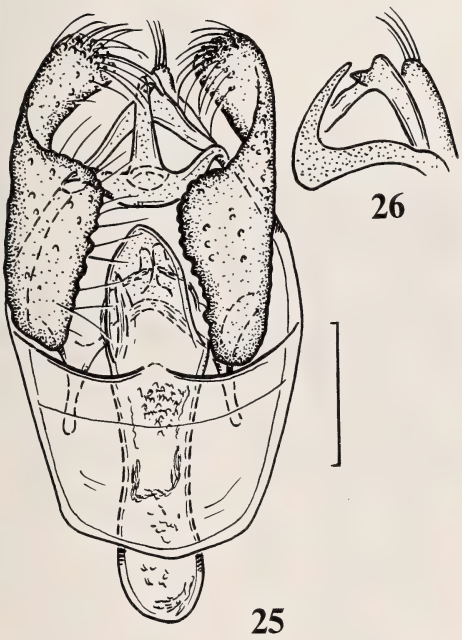
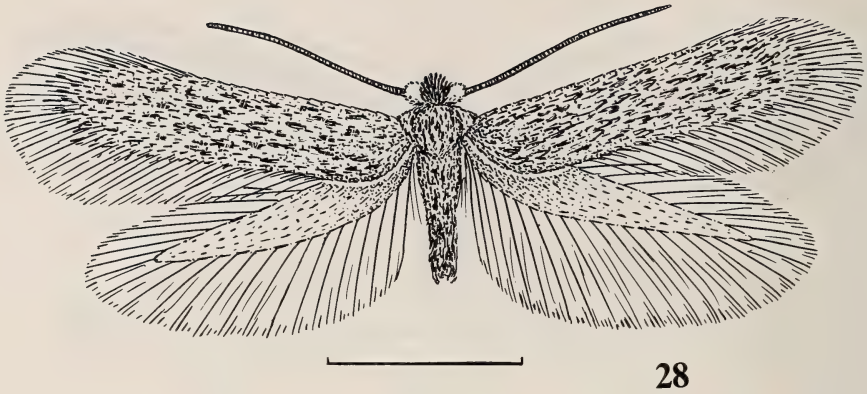
Figs. 21-23. *Acalyptris shafirkanus* (Pupl.), holotype, Uzbekistan, Ayakguzhumdy, 40 km E Dzhingildy, 10.VI.1965, leg. M. Falkovitsh : 21 – imago (scale 1 mm) ; 22 – male genitalia (scale 0,1 mm) ; 23 – same, lateral view of uncus and gnathos.





Figs. 24-27. *Acalyptris desertellus* (Pupl.): 24 – holotype, Uzbekistan, Zhamansaj, 140 km N-W Shafirkan, 20.V.1967, leg. M. Falkovitsh (scale 1 mm); 25 – male genitalia, same data (scale 0,1 mm); 26 – same, lateral view uncus and gnathos; 27 – female genitalia, Turkmenistan, Sandykatchi, 30.IV.1986, leg. R. Puplesis (scale 0,1 mm).



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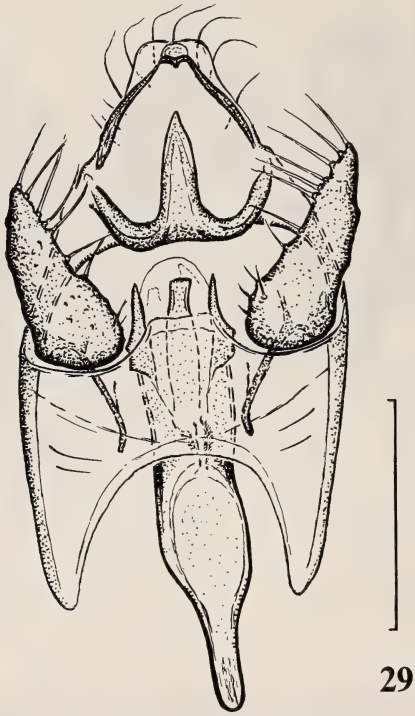

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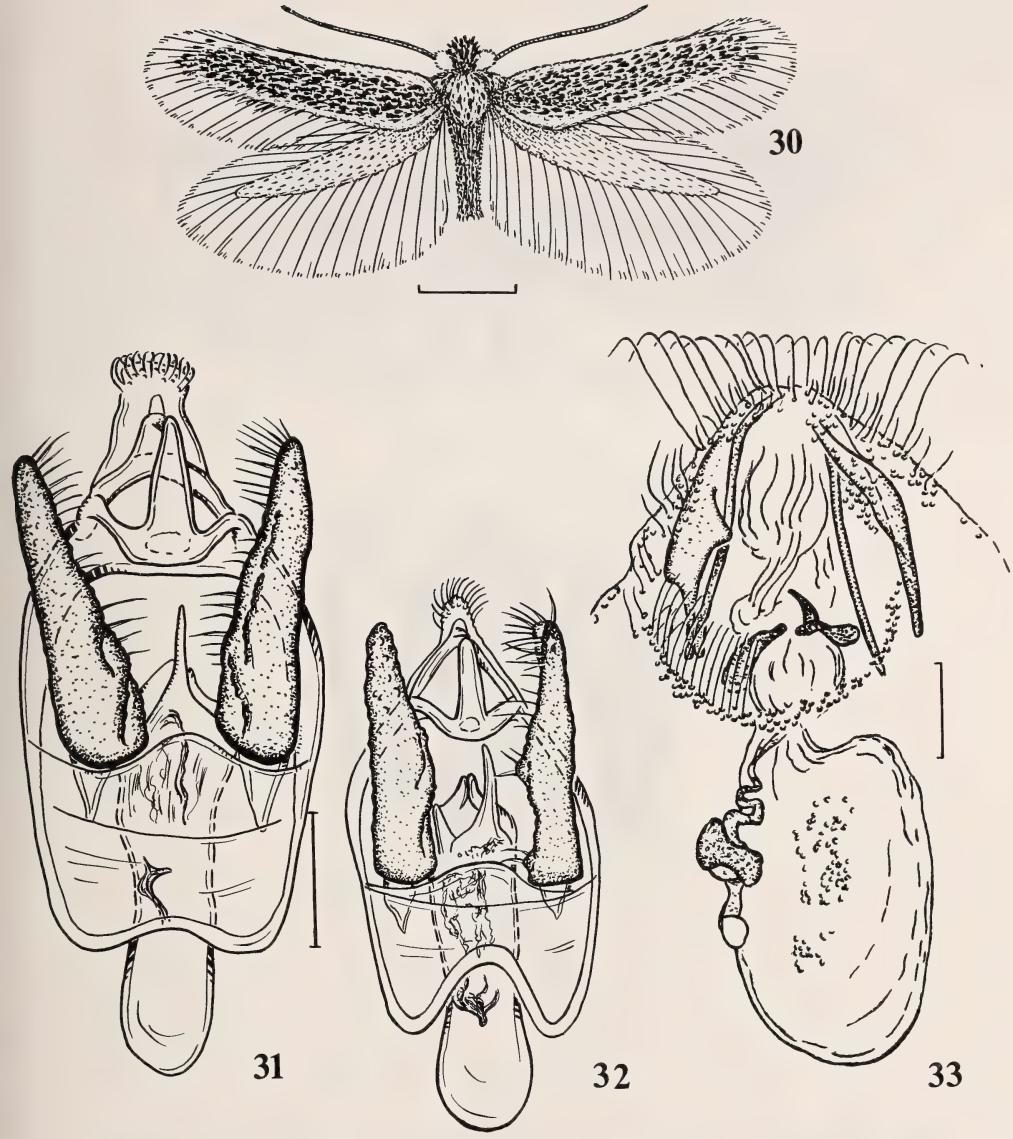
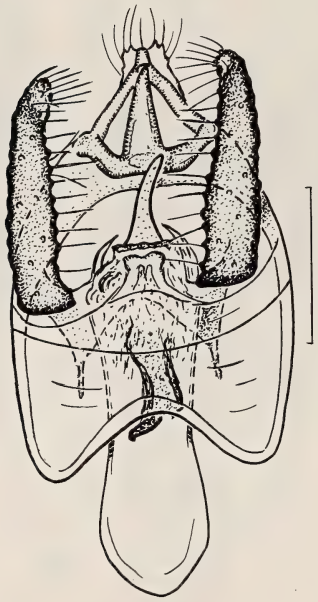
Figs. 28-29. *Acalyptris piculus* sp. n., holotype, Tadzhikistan, 30 km N Dushanbe, 15.VIII.1986, leg. R. Puplesis: 28 – imago (scale 1 mm); 29 – male genitalia (scale 0,1 mm).



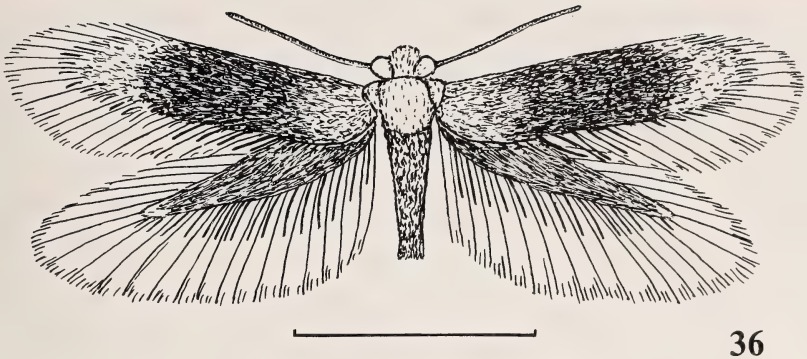
Figs. 30-33. *Acalyptris kizilkumi* (Falk.) : 30 – holotype, Uzbekistan, 7 km N Tamdybulak, 5.V.1965, leg. M. Falkovitsh (scale 1 mm) ; 31 – male genitalia, holotype, same data (scale 0,1 mm) ; 32 – male genitalia, Tadzhikistan, 30 km N Dushanbe, Kondara, 20.VIII.1986, leg. R. Puplesis (scale 0,1 mm) ; 33 – female genitalia, Turkmenistan, Sandykatchi, 1.V.1986, leg. R. Puplesis (scale 0,1 mm).

34



35

Figs. 34-35. *Acalyptris brevis* sp. n., holotype, Turkmenistan, env. Ashkhabad, 7.VIII.1988, leg. R. Puplesis : 34 – imago (scale 1 mm) ; 25 – male genitalia (scale 0,1 mm).



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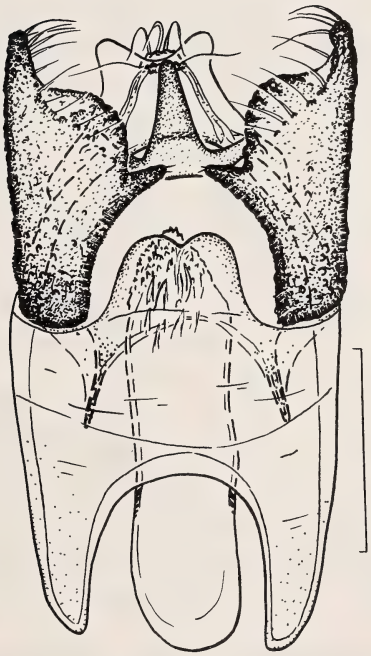

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Figs. 36-37. *Acalyptris egidijui* sp. n., holotype, Turkmenistan, Tedzhen, 8.VIII.1988, leg. R. Puplesis : 36 – imago (scale 1 mm) ; 37 – male genitalia (scale 0,1 mm).

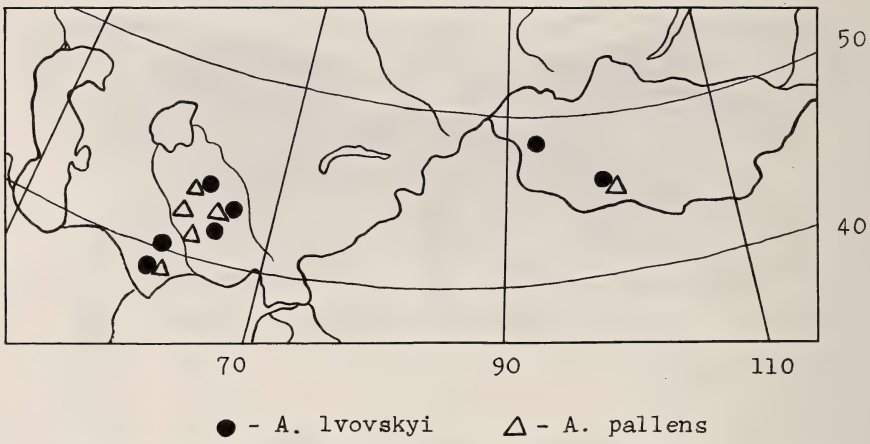

Fig. 38. Distribution of *Acalyptris lvovskyi* (PUPL.) and *A. pallens* (PUPL.).

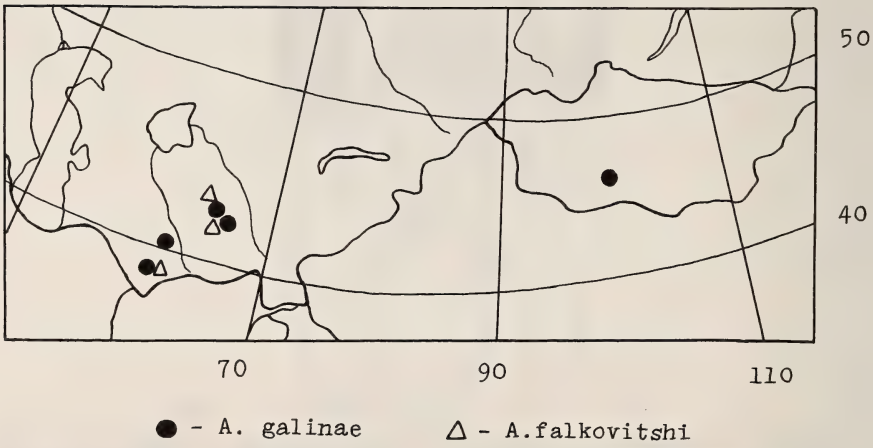

Fig. 39. Distribution of *Acalyptris galinae* (PUPL.) and *A. falkovitshi* (PUPL.).

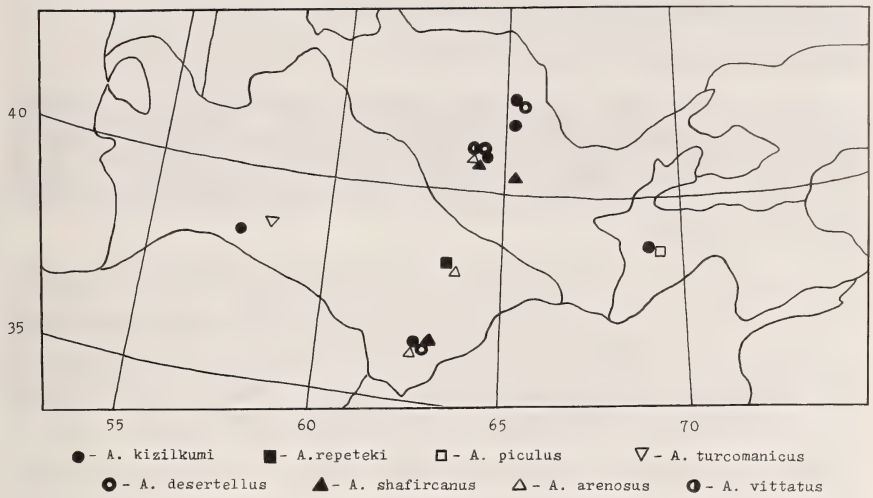

Fig. 40. Distribution of *Acalyptris* spp.

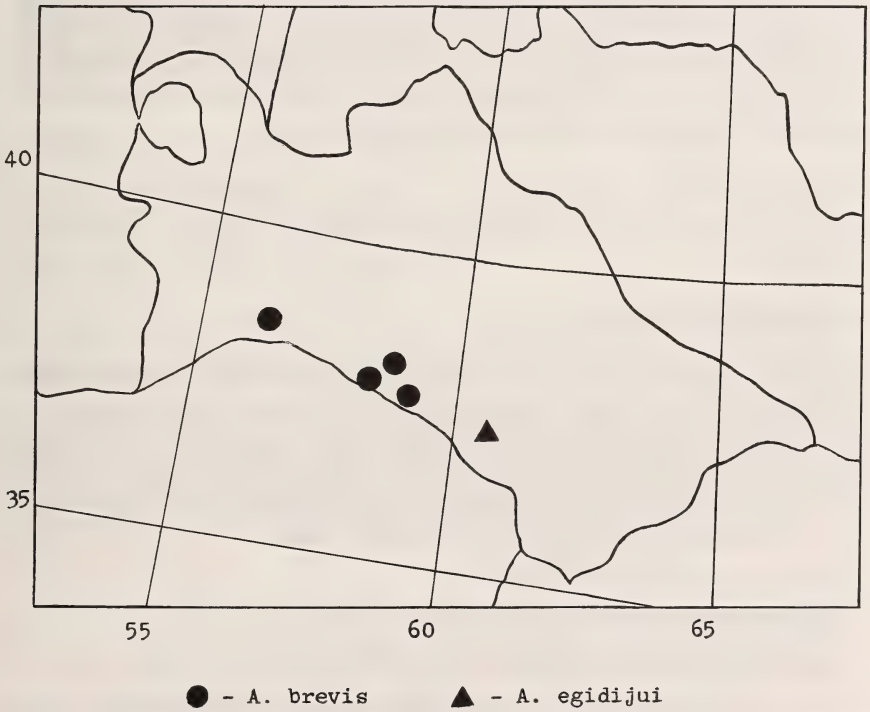

Fig. 41. Distribution of *Acalyptris brevis* sp. n. and *A. egidijui* sp. n.

Acalyptris galinae **(Puplesis)** (figs. 17-18, 39).

Microcalyptris galinae Puplesis, 1984 : 503.

A. galinae is externally very similar to both *A. shafirkanus* and *A. pallens* (fig. 17). It is easily separated from the latter by its small size and absence of abdominal tufts. *A. galinae* is recognized by its male genitalia : valvae small and slightly narrowed apically, aedeagus and its apical lobes with characteristic shape (fig. 18).

Material examined : 2 ♂ (holotype and paratype of *A. galinae galinae* Puplesis), Mongolia, Bojan Chongor aimak, 160 km S Shine-Dzhista, 3-11.VIII.1981, A. Lvovskyi ; 1 ♂ (holotype of *A. galinae mesasiaticus* Puplesis), USSR, Uzbekistan, Zhamansaj, 140 N-W Shafirkan, 20.V.1967 ; 2 ♂ (paratypes of *A. galinae mesasiaticus*), Turkmenistan, Repetek, 28.VIII.1981 and 22.VI.1982, V. Krivochatskyi ; 19 ♂, 3 ♀, Turkmenistan, Sandykatchi, 29.IV-5.V.1986, R. Puplesis.

Acalyptris repeteki **(Puplesis)** (figs. 19-20, 40).

Microcalyptris repeteki Puplesis, 1984 : 494.

Characterised externally by the pale colour of the forewings and absence of tufts of androconial scales on the abdomen (fig. 19). In this respect it could be confused with *A. galinae* and *A. shafirkanus*. In its genitalia *A. repeteki* mostly resembles *A. lvovskyi* and *A. falkovitshi*. However, in contrast to *A. lvovskyi* the gnathos in this species is caudally pointed and compared to *A. falkovitshi*, the valvae are longer and slender (fig. 20).

Female unknown.

Material examined : 1 ♂ (holotype), Turkmenistan, Repetek, 4.V.1983, M. Falkovitsh.

The *shafirkanus* group

Unlike the *repeteki* group, the genitalia of the species in this group have a typical uncus in the form of an inverted "v", with sharp ventral tooth. The pectinifer on the valvae and abdominal tufts of androconial scales are apparently absent. The species are not restricted to desert habitats, as some have been found in the mountainous parts of Tadzhikistan and Turkmenistan (the Kopet-Dag mountains) and others are found in the Mediterranean region (e.g. *A. minimella* Rebel).

Acalyptris shafirkanus **(Puplesis)** (figs. 21-23, 40).

Microcalyptris shafirkanus Puplesis, 1984 : 493.

Moths pale, unicolourous, externally very similar to *A. galinae*, but abdominal tufts absent (fig. 21).

Easily separated from all other species by the male genitalia : vinculum very broad, aedeagus with three large lobes apically, valves, unlike *A. desertellus*, broadened basally (fig. 22).

MATERIAL EXAMINED : 7 ♂ (holotype and paratypes), Uzbekistan, Ayakguzhumdy, 40 km E Dzhingildy, 10-15.VI.1965, 1 ♂ (paratype), Uzbekistan, Bukhara Region, Shafirkan, 4.IX.1971, M. FALKOVITSH ; 3 ♂, Turkmenistan, Sandykatchi, 1-4.V.1986, R. PUPLESIS.

Acalyptris desertellus **(PUPLESIS)** (figs. 24-27, 40).

Microcalyptris desertellus PUPLESIS, 1984 : 493-494.

This species is nearest to *A. shafirkanus* from which it differs by the pale brownish scales on the forewings, only the margins remaining creamy (fig. 24). The valva and aedeagus are quite different from all other *Acalyptris* species, the aedeagus having one large apical lobe. Transverse bar of transtilla present, but flimsy (fig. 25). Anterior apophyses in female very broad (fig. 27).

MATERIAL EXAMINED : 2 ♂ (holotype and paratype), Uzbekistan, Zhamansaj, 140 km N-W Shafirkan, 20.V.1967 ; 3 ♂ (paratypes), Uzbekistan, 7 km N Tamdybulak, 5-6.V.1965, M. FALKOVITSH ; 5 ♂, 2 ♀, Turkmenistan, Sandykatchi, 30.IV-3.V.1986, R. PUPLESIS.

Acalyptris piculus **sp. n.** (figs. 28-29, 40).

HOLOTYPE : ♂, Tadzhikistan, 30 km N Dushanbe, 15.VIII.1986, R. PUPLESIS.

PARATYPES : 1 ♂, same locality as holotype, 28.VI.1986, R. PUPLESIS ; 2 ♂, same locality, 21.VIII.1986, R. PUPLESIS.

DIAGNOSIS : Very closely related to *A. minimella* (REBEL) ; characterised by the basally strongly narrowed aedeagus, and by the long arms of the transtilla and lateral lobes of vinculum.

DESCRIPTION : Male. Forewing length 1.7-1.8 mm. Head : frontal tuft greyish-brown or brownish-grey. Eye-caps greyish-cream. Antennae brown. Forewings and thorax creamy, more or less irrorate with sparse greyish-brown scales (fig. 28). Cilia creamy. Hindwing brownish-grey.

Female unknown.

Male genitalia (fig. 29) : Tegumen narrowed into slightly sclerotized pseuduncus, not angular, some long setae dorsally. Uncus in form of inverted "v", ventrally a medial pointed tooth. Gnathos with long central element, which can be narrower than in holotype (fig. 29). Vinculum anteriorly bilobed, lobes long. Valvae triangular, with long stout setae apically. Arms of transtilla

very long and thin, occasionally slightly curved distally. Aedeagus strongly narrowed basally ; apically with one ventral and two lateral lobes.

MATERIAL EXAMINED : The type series only.

Acalyptris kizilkumi **(FALKOVITSH)** (figs. 30-33, 39).

Microcalyptris kizilkumi FALKOVITSH, 1986 : 167-168.

Externally similar to *A. falkovitshi* : forewing margins free of brown scales, creamy (fig. 30). Male can be easily separated from *A. falkovitshi* by the absence of abdominal tufts. Male distinguished from other species by form of valvae and aedeagus (with large apical spine ventrally) (fig. 31). The genitalia of this species are extremely variable in size, and form of valvae (fig. 32). In the female genitalia, the anterior apophyses are basally broad and narrowed apically. Many long different setae surround the tip of the abdomen in this species (fig. 33).

MATERIAL EXAMINED : 1 ♂ (holotype), Uzbekistan, 7 km N Tamdybulak, 5.V.1965, M. FALKOVITSH ; 1 ♂, Aznek, 70 km S Tamdybulak, 1.V.1965 ; 1 ♂, Ayakguz-humdy, 40 km E Dzhingildy, 26.IV.1965, M. FALKOVITSH ; 8 ♂, 5 ♀, Turkmenistan, Sandykatchi, 29.IV-5.V.1986 ; 3 ♂, 1 ♀, Turkmenistan, 30 km W Ashkhabad, env, Geok-Tepe, canyon Tshuli, 12.V.1986, R. PUPLESIS ; 1 ♂, Tadzhikistan, 30 km N Dushanbe, canyon Kondara, 20.VIII.1986, R. PUPLESIS.

Acalyptris brevis **sp. n.** (figs. 34-35, 41).

HOLOTYPE : ♂, Turkmenistan : env. Ashkhabad (desert), 7.VIII.1988, R. PUPLESIS.

PARATYPES : 1 ♂, Turkmenistan, canyon Firiuza, env. Ashkhabad (Central Kopet-Dag ridge), 9.V.1986, R. PUPLESIS ; 1 ♂, Turkmenistan, Kalininsk, env. Ashkhabad (Central Kopet-Dag ridge), 6.VIII.1988, R. PUPLESIS ; 1 ♂, Turkmenistan, env. Yuvan-Kala, 30 km E Kara-Kala (Western Kopet-Dag ridge), 18.VIII.1988, R. PUPLESIS.

DIAGNOSIS : Most closely related to *A. kizilkumi* (FALKOVITSH), but easily distinguished by its small size, speckled forewings and structure of the male genitalia, primarily in the narrow arms of the transtilla.

DESCRIPTION : Male. Forewing length 1.5-1.9 mm. Head : frontal tuft pale orange (tinged brown), eye-caps creamish white. Antennae brown on upperside and lighter on underside. Palpi "dirty" cream. Thorax, tegulae and forewings speckled : creamish grey, scattered with darkish brown scales (fig. 34). Hindwings brownish. Cilia of both wings creamy grey to grey.

Female. Unknown.

Male genitalia (fig. 35). Tegumen distinctly produced into broad and long pseuduncus. Weaker developed and sclerotized than in *A. kizilkumi* and slightly variable in length and width. Valvae narrow, inner edge with long chaetae on numerous papillae. Transtilla arms longer than in *A. kizilkumi* and always very narrow. Vinculum with two broad lateral lobes rounded apically. Juxta weakly sclerotized ; caudally slightly bilobed. Aedeagus with very large sclerotized apical spine, slightly bent and not very pointed. Two lateral processes in apical part of aedeagus. One very large and wide cornutus.

MATERIAL EXAMINED : the type series only.

***Acalyptris egidijui* sp. n.** (figs. 36-37, 41).

HOLOTYPE : ♂, Turkmenistan, Tedzhen (oasis), 8.VIII.1988, R. PUPLESIS.

PARATYPE : ♂, same data as holotype.

DIAGNOSIS : Most closely related to *A. minimella* (REBEL) and *A. loranthella* (KLIMESCH). Easily distinguished from all species of the group by form of valvae, juxta and bilobed uncus. Externally it differs by its distinctive coloration : yellowish forewings medially darkened by black scales.

DESCRIPTION : Male. Forewing length 1.4-1.6 mm. Head : frontal tuft brownish yellow, eye-caps creamish yellow, shiny. Antennae yellowish brown. Tegulae creamy yellow. Thorax possibly yellowish above (colour obliterated by pin in type series). Thorax, legs and palpi creamy yellow, shiny. Forewings creamish yellow, medially darkened by black scales (fig. 36). Hindwings on both sides covered with black scales. Cilia of both wings light, creamy yellowish.

Female. Unknown.

Male genitalia (Fig. 37). Tegumen produced into bilobed pseuduncus with several chaetae. Each lobe rounded apically. Uncus with sharp ventral tooth. Valvae narrowed at apex, strongly bulged medially, with distinct process on inner edge ; basally slightly narrowed. Arms of transtilla long and narrow. Transverse bar of transtilla thin. Juxta bilobed. Vinculum with two large lateral lobes. Aedeagus apically with some weakly sclerotized spine-like cornuti.

MATERIAL EXAMINED : the type series only.

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Beitrag zur Kenntnis der Gattung *Stenoptilia* Hübner, 1825 (Lepidoptera, Pterophoridae)

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Zusammenfassung

Der Lectotypus von *Stenoptilia paludicola* (Wallengren, 1859) wurde untersucht und festgelegt. Dabei stellte es sich heraus, daß diese ein jüngeres Synonym zu *Stenoptilia pterodactyla* (Linnaeus, 1761) ist. Die bisherigen Deutungen von *paludicola* werden gesichtet und diskutiert. Es wurde erkannt, daß das bisher als *paludicola* angesprochene Taxon mit *Stenoptilia gratiolae* Gibeaux & Nel, 1990, identisch ist. Zwei *Stenoptilia*-Arten werden neu in die Literatur eingeführt : *Stenoptilia amseli* sp. n. und *Stenoptilia lucasi* sp. n.

Summary

The lectotype of *Stenoptilia paludicola* (Wallengren, 1859) has been studied and designated. This taxon is found to be a junior synonym of *Stenoptilia pterodactyla* (Linnaeus, 1761). A review is given of the different interpretations of *paludicola*. The name has been used for a complex of different taxa, but it is identified now as *Stenoptilia gratiolae* Gibeaux & Nel, 1990. *Stenoptilia amseli* sp. n. and *Stenoptilia lucasi* sp. n. are described.

Durch das Entgegenkommen der Kollegen des Museums Lund ist es möglich geworden, den Lectotypus von *Mimaeseoptilus paludicola* Wallengren, 1859, zu untersuchen. Dabei ergab sich eine Synonymie mit *Stenoptilia pterodactyla* (Linnaeus, 1761). Verschiedene Autoren versuchten bisher in Unkenntnis dieses Sachverhaltes, *paludicola* zu deuten. Daraus resultiert eine gewisse Konfusion, die hiermit beendet werden soll. Zur Richtigstellung werden die Angaben in einigen häufig verwendeten Publikationen herangezogen, in denen *paludicola* angeführt wird :

1) Hannemann, 1977 : 55 faßt *paludicola*, ohne auf die Genitalarmaturen einzugehen, als Form von *pterodactyla* auf.

2) Buszko, 1979 : 41. 45, Fig. 79, 80. ♂ 47, Fig. 93 ♀ gibt *paludicola* als sp. bon. an. Es handelt sich um *Stenoptilia gratiolae* Gibeaux & Nel, 1990.

3) Gibeaux, 1985 : 244. 247, Fig. 17 ♂. 257, Fig. 34 ♀. 264, Fig. 48 ♂ publiziert *paludicola*, doch dürften ihm einige Fehldeutungen unterlaufen sein. Während die Abbildung des rechten Vorderflügels durch die über den Apex laufende Basallinie der Fransen des Hinterzipfels, Ähnlichkeit mit *paludicola* sensu Buszko, 1979, hat, ist dies bei der Abbildung des weiblichen Genitals durchaus nicht der Fall. Bei diesem dürfte es sich vielmehr um *Stenoptilia elkefi* Arenberger, 1984, handeln, die nach neueren Untersuchungen auch in Frankreich gefunden worden ist. Bei der Abbildung des männlichen Genitals spricht der relativ dicke Uncus, sowie der gleichmäßig gerundete Außenrand der Valve gegen seine Identität mit *paludicola* sensu Buszko. Gibeaux dürfte eine andere Art vor sich gehabt haben.

4) Zagulajev, 1986 : 98. 103, Fig. 2. 113, Fig. 3, 4 ♂. 118, Fig. 1 ♀ benützte den Namen *paludicola* in gleicher Weise wie Buszko, doch ist bei seiner Abbildung der Imago (103, Fig. 2) die in den Fransen des Hinterzipfels der Vorderflügel um den Apex laufende basale Schuppenlinie nicht zu erkennen.

5) Razowski, 1988 : 57. 109, Fig. 97, 98 ♂. 121, Fig. 190. ♀ folgte weitgehend Buszkos Angaben und verwendete sichtlich auch dessen Zeichnungen.

6) Gibeaux & Nel, 1990 schließlich führten die Species *Stenoptilia gratiolae* Gibeaux & Nel, 1990 in die Wissenschaft ein. Es handelt sich dabei um das gleiche Taxon, das bisher unter *paludicola* sensu Buszko bekannt war.

Im nachfolgenden systematischen Teil wird auf den neuen taxonomischen Stand von *Stenoptilia pterodactyla* (Linnaeus, 1761) und *Stenoptilia gratiolae* Gibeaux & Nel, 1990 eingegangen und die beiden Arten miteinander verglichen. Des weiteren werden *Stenoptilia amseli* sp. n. aus Saudi Arabien und *Stenoptilia lucasi* sp. n. aus Kleinasien neu beschrieben.

Stenoptilia pterodactyla (Linnaeus, 1761) (Abb. 1, 2, 5, 9, 10, 12, 17)

Phalaena Alucita pterodactyla Linnaeus 1761, Fauna Suecica Nr. 1456. Taf. 2, Fig. 8. Stockholmiae.

Synonymie :

Pterophorus fuscus Retz, 1783. In : De Geer Gen. Spec. Ins. : 35.
Alucita fuscodactyla Haworth, 1811, Lepidoptera Britannica. Part 3 : 476.
Alucita ptilodactyla Hübner, 1813, Samml. Eur. Schmett. Alucit. Taf. 3, Fig. 16.

Abb. 1. *Mimaeseoptilus paludicola* WALLENGREN. Lectotypus.

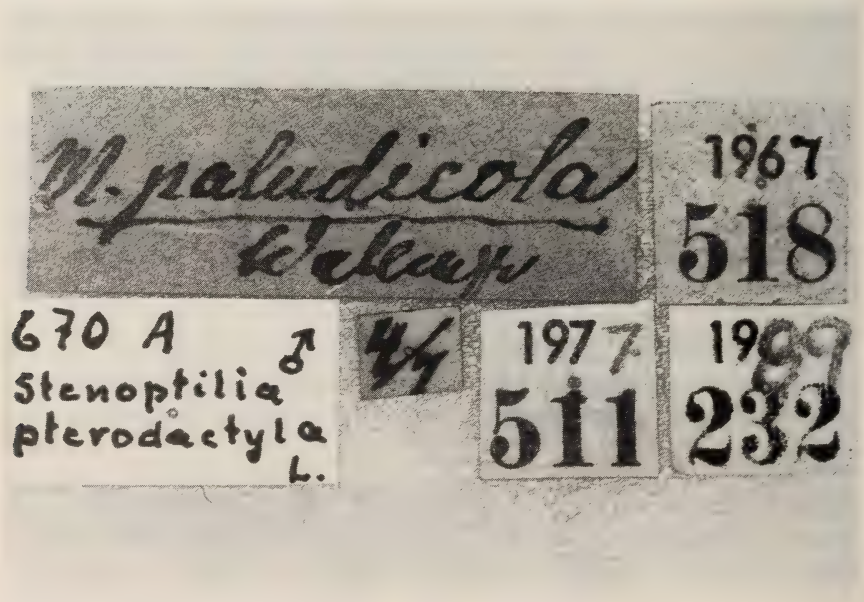


Abb. 2. *Mimaeseoptilus paludicola* WALLENGREN. Originaletiketten des Lectotypus.

Abb. 3. *Stenoptilia gratiolae* Gibeaux & Nel.

Abb. 4. *Stenoptilia gratiolae* Gibeaux & Nel. Vorderflügel.

Abb. 5. *Stenoptilia pterodactyla* LINNAEUS. Vorderflügel.

Abb. 6. *Stenoptilia bipunctidactyla* SCOPOLI. Vorderflügel.

Abb. 7. *Stenoptilia amseli* sp. n.

Abb. 8. *Stenoptilia lucasi* sp. n. Vorderflügel.

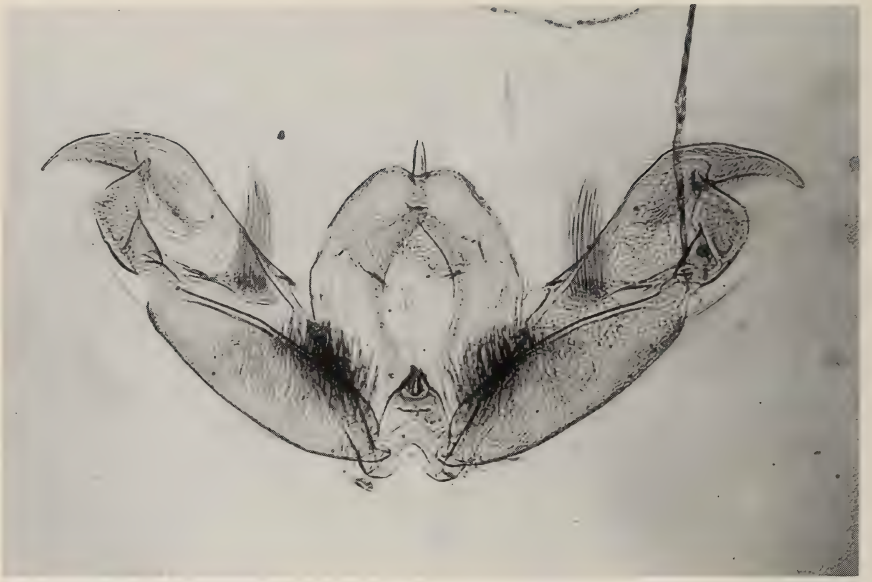


Abb. 9. *Mimaeseoptilus paludicola* WALLENGREN. Lectotypus. Männlicher Genitalapparat.

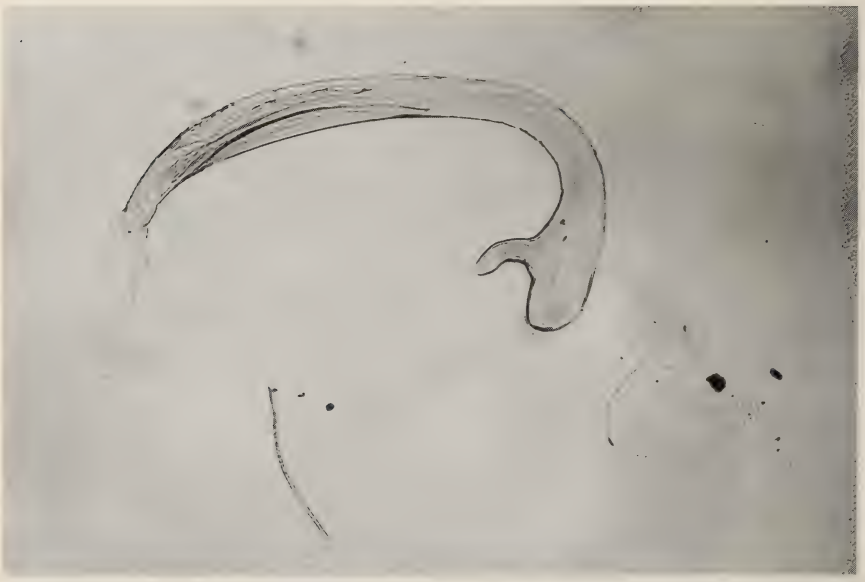


Abb. 10. *Mimaeseoptilus paludicola* WALLENGREN. Lectotypus. Männlicher Genitalapparat. Aedoeagus.

Stenoptilia ptilodactyla Hübner, 1825, Verz. bek. Schmett. ; 430.
Mimaeseoptilus paludicola Wallengren, 1859, Skandinaviens Fjädermott (Alucita Lin.). Till. K. Vet. Akad. Handl. 3 (7) : 18.

Lectotypus, ♂ (hier festgelegt) : „*M. paludicola* Wallengr.", „670 A, *Stenoptilia pterodactyla* L., ♂" (Genitaluntersuchung R. Johansson det.). „4/7", „Lectotypus, ♂, *Mimaeseoptilus paludicola* Wallengren, Arenberger des., 1990". Coll. Zoolog. Institut Lund. — **syn. n.**

Stenoptilia gratiolae Gibeaux & Nel, 1990 (Abb. 3, 4, 11, 16).
Bull. ANVL Vol. 65 (4), 1989 : 199-209.

Synonymie :

Pterophorus fuscus Retz var. c und d Zeller, 1852, Linnaea Entomologica 6 : 371-373.
Stenoptilia fusca var. *paludicola* Wallengren, Hofmann 1896, Die deutschen Pterophorinen. Berichte des naturwissenschaftlichen Vereines zu Regensburg 5 : 85.

Literatur :

Schwarz, 1953 : 132, Fig. 496. 413-416 (als *Stenoptilia paludicola* Wallengren, 1859).
Buszko, 1979 : 41. 45, Fig. 79, 80. 47, Fig. 93 (als *Stenoptilia paludicola* Wallengren, 1859).
Zagulajev, 1986 : 98. 103, Fig. 2. 113, Fig. 3, 4. 118, Fig. 1 (als *Stenoptilia paludicola* Wallengren, 1859).
Razowski, 1988 : 57. 109, Fig. 97, 98. 121, Fig. 190 (als *Stenoptilia paludicola* Wallengren, 1859).

Verbreitung

Frankreich, Italien, Deutschland, Österreich, Polen, Rußland. Es ist anzunehmen, daß *gratiolae* mit der Futterpflanze über ganz Europa verbreitet ist.

Erste Stände und Ökologie

Als Biotope kommen feuchte Stellen an Teichrändern und Tümpeln in Frage. Die Futterpflanze ist *Gratiola officinalis* Linnaeus (Scrophulariaceae), die oft an überschwemmten Wiesen wächst. Die Raupe frißt im Frühjahr an den Herztrieben und wechselt oft die Pflanze (E. M. Hering i.l.). Nach Herings Beobachtungen erfolgte die Verpuppung ab 6. Juni, und die Falter schlüpften schon vom 12. Juni an. Es dürften zwei Generationen vorkommen. Das bestätigen die Daten der Funde aus Österreich, wobei die Angaben für die erste Gene-

ration die Monate Mai und Juni umfassen. Die zweite Generation erstreckt sich je nach Witterung von Ende Juli bis Anfang September. ZELLER fand die Falter bei Glogau Ende Juli und Anfang September.

ARTABGRENZUNG

Am häufigsten wird *gratiolae* mit *pterodactyla* verwechselt. Die Imagines der beiden Species sind durch die in den Fransen des Außenrandes der Hinterzipfel der Vorderflügel über den Apex hinauslaufende Schuppenlinie bei *gratiolae*, die bei *pterodactyla* nur durch einige Schuppenpunkte vorhanden ist, unterschieden (Abb. 4, 5).

Der Aedoeagus von *gratiolae* gehört zum „kurzen" Typus, das heißt, er ist kürzer als die Valvenlänge. *Pterodactyla* hingegen zählt zum „langen" Aedoeagustypus, das heißt, der betreffende Aedoeagus ist länger als die Valve des dazugehörenden Tieres (Abb. 11, 12).

Das Antrum im weiblichen Genitalapparat hat eine gewisse Ähnlichkeit mit dem von *bipunctidactyla* SCOPOLI, 1763. Doch sind die Seitenränder bei letzterer proximal nicht so stark verjüngt und konkav wie bei *gratiolae*. Ist das Antrum bei *gratiolae* und *bipunctidactyla* nur knapp doppelt so lang wie die Papillae anales, so mißt es bei *pterodactyla* etwa die dreifache Papillenlänge (Abb. 16, 17, 18).

Stenoptilia amseli sp. n.

HOLOTYPUS

♀: „SW-Arabien, Asirgebirge, 2350 m, 5 km s.[üdlich] Namas, 17.-21.4.1979, AMSEL leg.". GU 3189 ♀ Ar. Coll. LNK.

PARATYPEN

3 ♂♂, 3 ♀♀ mit den gleichen Daten wie der Holotypus. GU 3168 ♂, 1904, 750 ♀♀ AR.

Die Paratypen befinden sich in den Landessammlungen für Naturkunde (LNK) Karlsruhe und in der Sammlung ARENBERGER.

DIAGNOSE (Abb. 7)

Expansion 17-20 mm. Die Vorderflügel sind kaffeebraun mit Einmischung einiger dunkelbrauner, entlang der Costa auch weißer Schuppen. Am unteren Rand des Vorderzipfels erstreckt sich eine aus dunklen Schuppen gebildete, undeutliche Linie. Am Hinterzipfel gibt es deren zwei. Discoidal- und Spaltenpunkt etwa gleich groß, letzterer sitzt direkt an der Spalte. Fransen hellbraun, am Außenrand des Vorderzipfels mit zwei dunklen Schuppenpunkten, von denen einer direkt am Apex

Abb. 11. *Stenoptilia gratiolae* Gibeaux & Nel. Männlicher Genitalapparat. GU 2838.

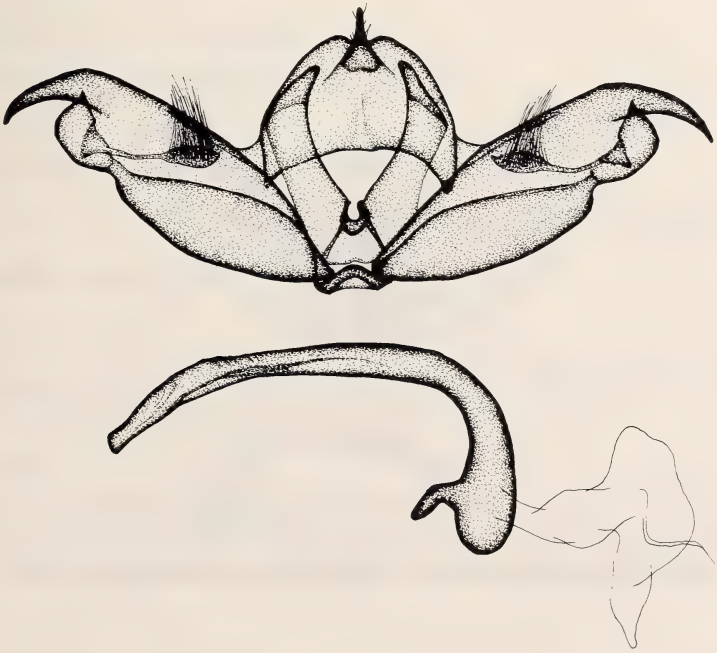


Abb. 12. *Stenoptilia pterodactyla* Linnaeus. Männlicher Genitalapparat. GU 2816.

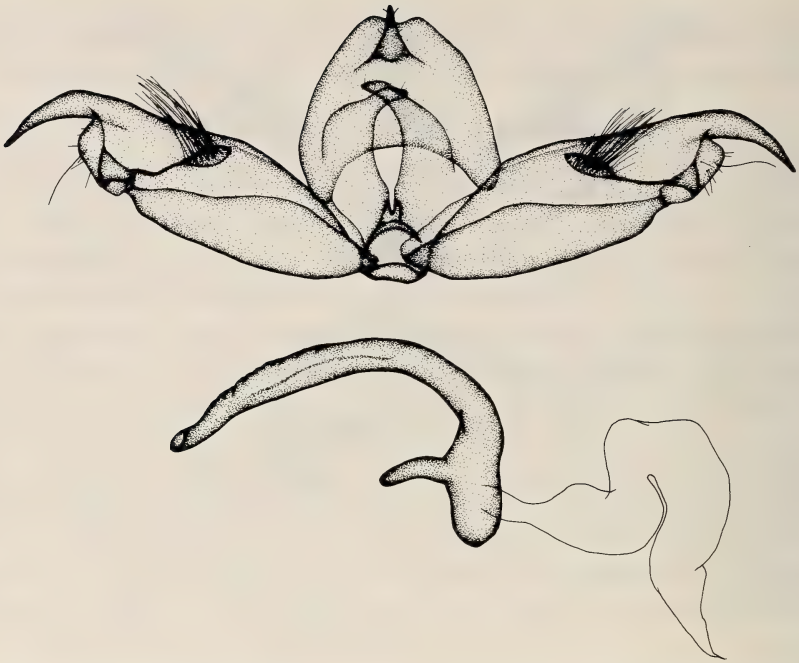


Abb. 13. *Stenoptilia bipunctidactyla* Scopoli. Männlicher Genitalapparat. GU 3417.

Abb. 14. *Stenoptilia amseli* sp. n. Männlicher Genitalapparat. GU 3168.

sitzt. Der Außenrand des Hinterzipfels mit drei dunklen Schuppenpunkten, die manchmal auch zu einer durchgehenden Basallinie verwachsen sein können. Hinterflügel gleichmäßig hellbraun.

Scheitel, Stirne und Palpen von gleicher Färbung wie die Vorderflügel. Antennenoberseite dunkelbraun, Unterseite hellgrau. Hinterbeine hellbraun. Der Innensporn des ersten Sporenpaares ist etwas länger als der äußere. Beim zweiten Sporenpaar sind beide Sporen gleich lang, aber kürzer als der Außensporn des ersten Paares.

Genitalien

♂ (Abb. 14): Außenrand der Valven halbkreisförmig, der Cucullus bogenförmig, wenig zugespitzt. Der Analrand des Tegumens ist eingebuchtet, der Uncus relativ dünn. Er überragt das Tegumen. Aedoeagus schwach gebogen, etwa im Winkel von 105°, der Basalfortsatz steht etwa 75° ab.

Genitalien

♀ (Abb. 19): Antrum von gleicher Länge wie der Ductus bursae, beidseitig leicht bauchig, vor dem Ostium linksseitig erweitert. Das Corpus bursae ist blasenförmig, die beiden Signa sind relativ dünn. Der Ductus seminalis zweigt knapp vor der Einmündung des Ductus bursae in das Corpus bursae ab. Apophyses anteriores fehlen. Die Apophyses posteriores sind borstenförmig und etwa 1 1/2 mal so lang wie das Antrum.

Erste Stände und Ökologie

Unbekannt. Flugzeit der Imago IV.

Verbreitung

Saudi Arabien : Asirgebirge.

Die neue Art wird Herrn Dr. H. G. Amsel in Dankbarkeit gewidmet.

Stenoptilia lucasi sp. n.

Holotypus

♀: „Asia min. or, Develi, Erciyes dagh, 1700 m, 11.-18.7.1970, Friedel". GU 2848 ♀ AR. Coll. Arenberger.

Paratypen

2 ♂♂, 2 ♀♀ mit den gleichen Daten wie der Holotypus.
6 ♂♂, 2 ♀♀: „Turkiye, Gümüshane, Spikör Gecidi, 2390-2500 m, 26.7.1989, I. A. W. Lucas". GU 3626, 2847 ♂♂, 2844 ♀ AR.

Die Paratypen befinden sich in den Sammlungen Lucas und Arenberger.

Diagnose (Abb. 8)

Expansion 16-20 mm. Die Vorderflügel sind braun mit zahlreichen weißen Schuppeneinsprenkelungen, die besonders zahlreich am unteren Faltenrand und im Hinterzipfel sind. In der Mitte des Vorderzipfels befindet sich ein länglicher, dunkler Fleck, schräg darüber an der Costa ein weiterer. Der Spaltenpunkt sitzt direkt an der Spaltung, der Diskoidalpunkt ist vorhanden. Die Fransen beider Zipfel sind basal weißlich, die Spitzen graubraun. Die Außenrandfransen des Hinterzipfels sind von zwei dunklen Schuppenbüscheln durchbrochen. Hinterflügel einfarbig braun.

Scheitel. Stirne, Antennen, Palpen braun. Die Oberseite des letzten Palpengliedes ist weiß. Das Abdomen ist braun mit zwei weißen Seitenlinien, die Analenden der einzelnen Abdominalglieder jeweils mit zwei schwarzen Punkten.

Genitalien

♂ (Abb. 15) : Der Valvenaußenrand ist etwas abgeflacht, der Cucullus relativ spitz, nur schwach abwärts gebogen. Die Anellusarme reichen fast bis zur Uncusbasis. Dieser ist vor der Spitze etwas verbreitert. Der Aedoeagus ist stark gebogen und länger als eine Valve.

Abb. 15. *Stenoptilia lucasi* sp. n. Männlicher Genitalapparat. GU 2846.

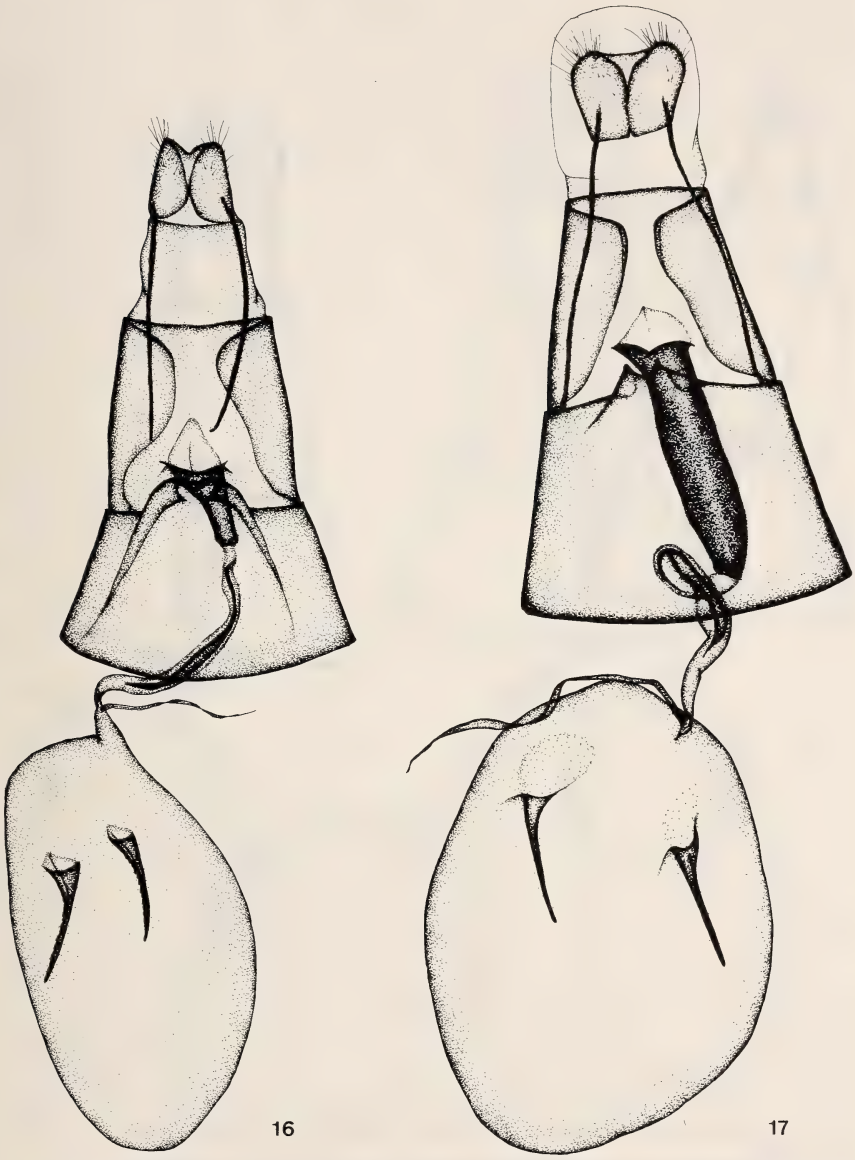
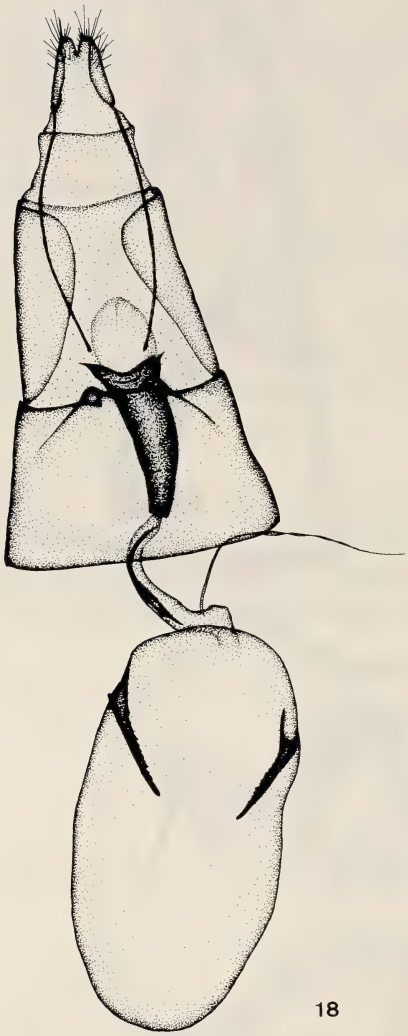


Abb. 16. *Stenoptilia gratiolae* Gibeaux & Nel. Weiblicher Genitalapparat. GU 2837.
Abb. 17. *Stenoptilia pterodactyla* Linnaeus. Weiblicher Genitalapparat. GU 2815.



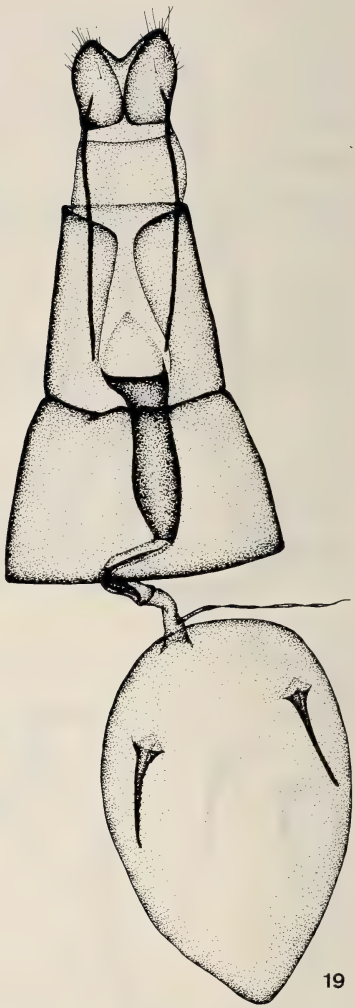


Abb. 18. *Stenoptilia bipunctidactyla* Scopoli. Weiblicher Genitalapparat. GU 10668, Mus. Vind.
Abb. 19. *Stenoptilia amseli* sp. n. Weiblicher Genitalapparat. GU 3189.

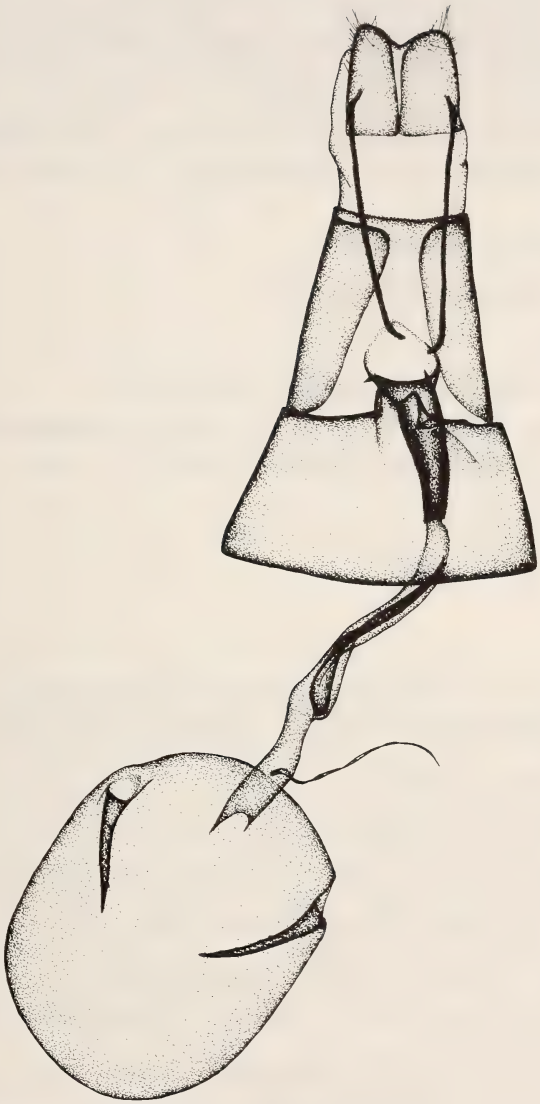


Abb. 20. *Stenoptilia lucasi* sp. n. Weiblicher Genitalapparat. Holotypus, GU 2848.

Genitalien

♀ (Abb. 20) : Antrum bei ventraler Ansicht in Schräglage, zur rechten Körperhälfte orientiert. Es ist stark sklerotisiert und hat etwa die halbe Länge der Apophyses posteriores. Sein Analrand ist kreisförmig ausgeschnitten, die Seitenränder der Ostiumöffnung sind analwärts vorgezogen. Der Ductus bursae ist doppelt so lang wie das Antrum. Der Ductus seminalis zweigt unmittelbar vor der Einmündung des Ductus bursae in das Corpus bursae ab. Letzteres mit zwei kräftigen Signa. Apophyses anteriores fehlen. Analende des 7. Sternits in seiner Mitte eingekerbt.

Erste Stände und Ökologie

Unbekannt. Flugzeit der Imago VII.

Verbreitung

Kleinasien : Erciyes Dagh : Develi. Gümüshane.

Der Dank des Autors gilt Herrn Dr. Lucas, der einen Großteil des bearbeiteten Materials zur Verfügung stellte. Die neue Art soll ihm gewidmet sein.

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Nota lepid. 13 (2-3) : 108-119 ; 30.IX.1990 ISSN 0342-7536

Contributions à la connaissance des Coleophoridae. LXI Trois espèces nouvelles du groupe de *Coleophora attalicella* Zeller, 1871 (Lepidoptera, Coleophoridae)

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Résumé

Dans le présent travail, trois nouvelles espèces du groupe de *Coleophora attalicella* Zeller, 1871 sont décrites : *C. mediae* sp. n. et *C. persana* sp. n., d'Iran, et *C. walsinghami* sp. n., de Syrie.

Summary

Three new species of the *Coleophora attalicella* Zeller, 1871 group are described : *C. mediae* sp. n. and *C. persana* sp. n., both from Iran, and *C. walsinghami* sp. n., from Syria.

Le groupe de *Coleophora attalicella* Zeller, 1871 est composé d'espèces dont les genitalia appartiennent au 30ème groupe du système de Toll (1952) tandis que l'habitus ressemble beaucoup à celui des espèces du 18ème groupe de ce même système, groupe caractérisé par des ailes antérieures à la couleur du fond ocre ou beige clair, avec toutes les nuances intermédiaires, rayées par des lignes longitudinales de couleur argent pur, d'extension variable. Les espèces connues, jusqu'à présent, sont les suivantes : *C. attalicella* Zeller, 1871, *C. quadrifariella* Staudinger, 1880, *C. amseliella* Toll & Amsel, 1967, *C. cyrta* Falkovitsh, 1973, *C. psamata* Falkovitsh, 1973, *C. nomgona* Falkovitsh, 1975. Bientôt, il faudra ajouter deux nouvelles espèces décrites par le Dr. Falkovitsh, qui sont actuellement sous presse : *C. kargani* et *C. tomentosa* (communication épistolaire de l'auteur).

Selon nos connaissances actuelles, on peut dire qu'il s'agit d'espèces de taille moyenne inféodées aux lieux arides, subdésertiques et même, parfois, saumâtres, vivant aux dépens de plantes appartenant à la

famille des *Chenopodiaceae*. Il faut cependant, remarquer que la biologie de la plupart des espèces est inconnue. Ce groupe est répandu de la Mongolie jusqu'aux Balkans, mais il est surtout bien représenté en Asie soviétique méridionale (Kazakhstan, Ouzbékistan, Turkménistan, etc.), en Afghanistan et en Iran. Une seule espèce est connue d'Europe (Roumanie et Hongrie). Elle est, actuellement, confondue avec *C. quadrifariella* Staudinger. Il est dans mes intentions d'en revoir le statut dans une prochaine note.

Le travail qui suit est uniquement consacré à la description de trois nouvelles espèces de ce groupe, espèces que j'ai découvertes au cours des années passées en étudiant le matériel indéterminé du Muséum national d'Histoire naturelle, Paris, et des Landessammlungen für Naturkunde de Karlsruhe : *Coleophora mediae* sp. n. et *C. persana* sp. n., toutes deux d'Iran, et *C. walsinghami* sp. n., de Syrie. Pour le prêt du matériel confié pour étude et pour les renseignements fournis, mes remerciements vont au Dr Gérard Ch. Luquet de Paris, au Prof. R. U. Roesler de Karlsruhe et au Dr K. Sattler de Londres. Le Dr P. Viette a eu l'amabilité de revoir le texte en français.

Abréviations :

BMNH = British Museum of Natural History.
LNK = Landessammlungen für Naturkunde, Karlsruhe.
MNHN = Muséum national d'Histoire naturelle, Paris.
Bldz = Baldizzone.

Coleophora mediae sp. n.

Holotype ♂ (PG Bldz 2648) : «Z-Iran, Kashan, 22.V.1970, Karkas berg, M. Abai leg.», coll. LNK.

Paratype ♀ (PG Bldz 9110) : «Ab Ask, Persien, 22.VII.1971, 1800 m, leg. Glaser», coll. Bldz.

Diagnose : Envergure 14-15 mm. Tête (Pl. I, fig. 1), thorax et abdomen de couleur crème. Palpes labiaux blancs : le deuxième article est à peu près 0,5 fois plus long que le diamètre de l'œil et que le troisième article. Antennes pourvues de quelques poils à la base du premier article, entièrement blanches. Ailes antérieures de couleur ocre clair pourvues de quelques écailles brunes, réunies dans la région apicale et sur la cellule. Des lignes argentées se trouvent sur la surface des ailes : la première le long de la costa en partant de la base, très large,

se termine en dessous de l'origine des franges ; la deuxième, soudée à la base avec la première, suit le trajet de la nervure cu_1, se terminant avant le bord de l'aile ; entre ces deux lignes se trouve une tache argentée allongée dans la région de la cellule ; la troisième ligne se trouve le long du dorsum, de la base jusqu'au début des franges.

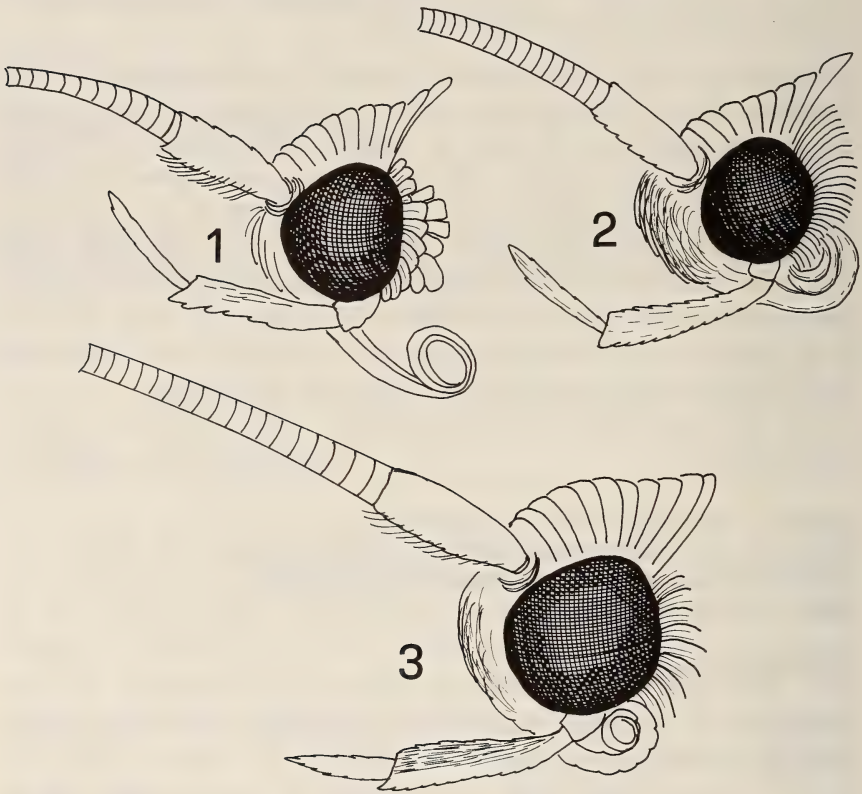

Planche I

Fig. 1. *C. mediae* sp. n. : tête.
Fig. 2. *C. walsinghami* sp. n. : tête.
Fig. 3. *C. persana* sp. n. : tête.

Génitalia mâles (Pl. II, fig. 4) : Gnathos petit, globuleux. Tegumen petit, rétréci en son milieu, pourvu de deux longs bras aplatis. Transtilla subtriangulaire, courbe en forme de faux. Valvula large et allongée, hérissée de soies minces, avec le bord dorsal concave et le bord ventral

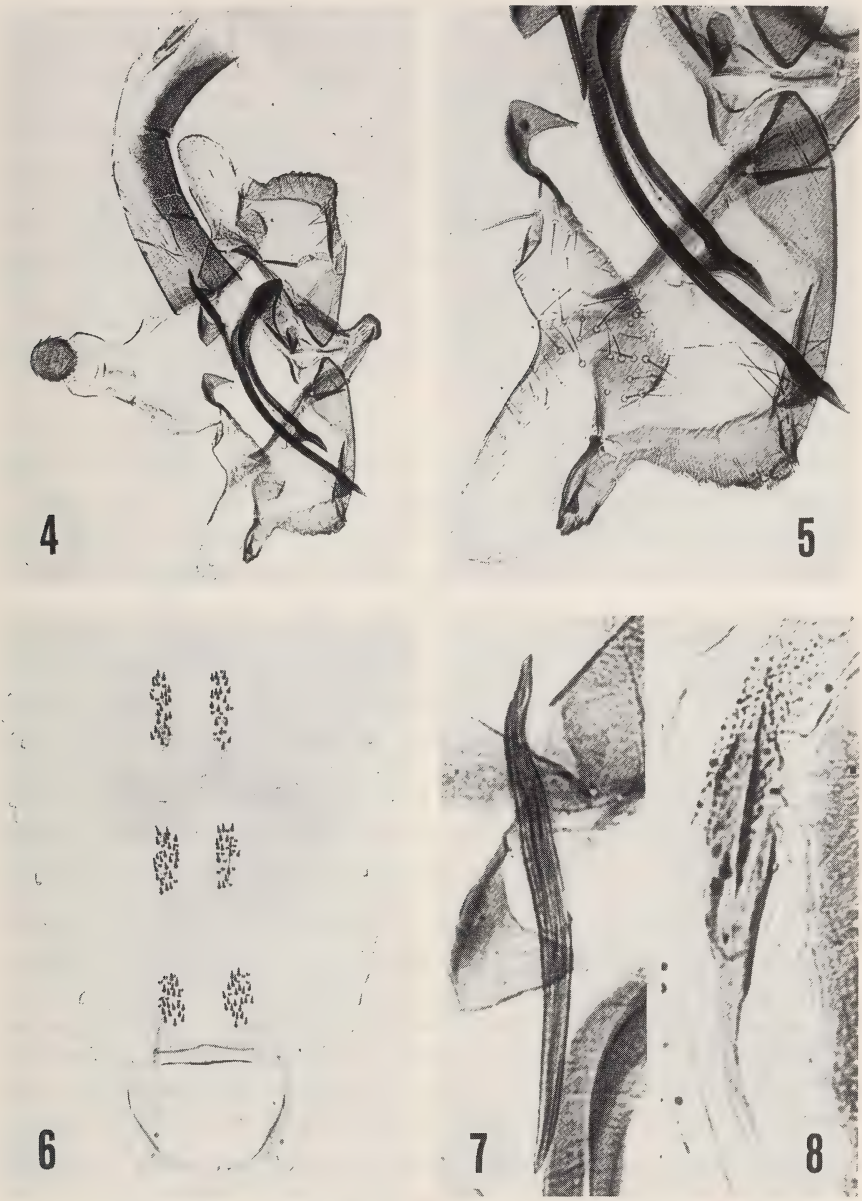

PLANCHE II

Fig. 4. *C. mediae* sp. n. : genitalia mâles.
Fig. 5. Idem : valve, sacculus et édéage grossis.
Fig. 6. Idem : abdomen.
Fig. 7, 8. Idem : cornuti.

convexe. Valve trapue, un peu allongée, plus étroite à la base. Sacculus large, très sclérifié, surtout le long des bords : le bord ventral est presque droit, tandis que le bord latéral est un peu convexe et dentelé, se terminant, dans l'angle dorso-caudal, par une protubérance trapue, pourvue d'une petite dent émoussée. Édéage étroit et allongé, constitué par deux baguettes minces, dont la plus courte atteint les 4/5 de l'autre : les deux sont pourvues d'une dent aiguë en position dorsale un peu avant l'apex. La vesica, sclérifiée ventralement, renferme deux grands cornuti de structure différente : celui qui se trouve en position proximale est étroit et très allongé en forme d'aiguille de pin, tandis que celui qui se trouve en position distale est large à la base, qui est aplatie, et se rétrécit vers l'apex, qui est légèrement courbe et en forme de bec.

Structures de renforcement de l'abdomen (Pl. II, fig. 6) : Pas de barres latéro-postérieures, celle transversale est presque droite, plus épaisse en son milieu. Disques tergaux (3ème tergite) à peu près 3,5 fois plus longs que larges, pourvus de petites épines coniques.

Genitalia femelles (Pl. III, fig. 9-10) : Papilles anales petites et allongées. Apophyses postérieures à peu près deux fois plus longues que les antérieures. Lamella antevaginalis subtrapézoïdale, avec le bord distal convexe, très creusé en son milieu, au niveau de l'ostium bursae qui est ogival. Lamella postvaginalis plus petite, presque rectangulaire. Infundibulum grand, subcylindrique, se continuant sous forme d'un entonnoir dans le ductus bursae, qui est caractérisé par trois parties différentes : la première, à peu près aussi longue que la lamella antevaginalis, est pourvue de deux bandes sclérifiées latérales, revêtues de petites épines coniques ; la deuxième, séparée de la première par une toute petite zone transparente, est à peu près 5 fois plus longue que la lamella antevaginalis et se caractérise par une bande spiralée recouverte d'épines longues ressemblant aux piquants d'un hérisson ; la troisième partie, à peu près aussi longue que la lamella antevaginalis, est constituée de deux circonvolutions, pourvues d'épines coniques émoussées très petites, qui deviennent encore plus petites, se transformant finalement en points, en allant vers la bursa. Corpus bursae petit, presque rond, pourvu d'un petit signum en forme de feuille.

Remarque : La nouvelle espèce doit être placée près de *C. nomgona* Falkovitsh, espèce qui peut être séparée par les différences suivantes dans les genitalia mâles : chez *mediae*, l'édéage est plus long avec une grande dent sur chaque baguette, tandis que *nomgona* n'en montre qu'une seule, plus petite ; les cornuti sont très différents ; le sacculus de *mediae* a le bord latéral plus droit, pourvu de petites dents, qui

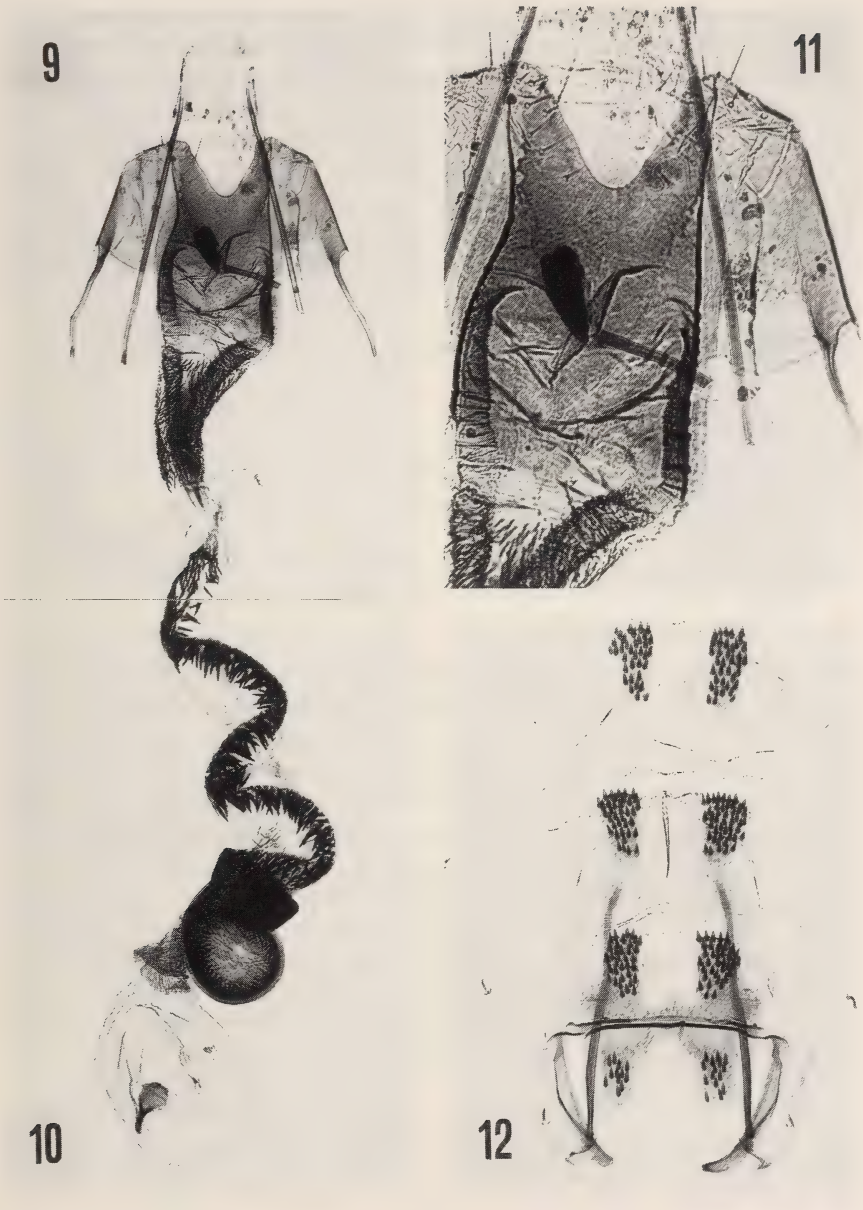

Planche III

Fig. 9-10. *C. mediae* sp. n. : genitalia femelles.
Fig. 11. Idem : particulièrement grossi.
Fig. 12. Idem : abdomen.

manquent chez *nomgona*. Les genitalia femelles de *mediae* sont assez différents de ceux de *nomgona*, notamment par les nombreuses épines de différentes longueurs se trouvant dans le ductus bursae. Par rapport aux genitalia femelles de *C. cyrta* Falkovitsh, les différences sont les suivantes : chez *mediae*, l'ostium bursae est plus étroit et plus profond ; l'infudibulum de *mediae* est plus court et trapu ; la première partie du ductus bursae de *mediae* est pourvue d'épines plus minces et allongées ; *mediae* n'a qu'un seul signum dans la bursa, tandis que *cyrta* en a deux, dont l'un semblable à une feuille et l'autre irrégulièrement allongé et dentelé.

Répartition géographique : Iran central.

C. persana sp. n.

Holotype ♂ (PG Bldz 5424) : «NW-Iran, 15 km sö. Maku, 1050 m, 3.VI.1975, H. G. Amsel leg.» coll. LNK.

Paratypes : 1 ♂ (PG Bldz 5735) ibidem, 7.VI.1975, coll. Bldz. 1 ♂ (PG Bldz 5726) : «N-Iran, 70 km S Teheran, 1300 m, 29.V.1969, H. G. Amsel leg.» coll. LNK.

Diagnose : Envergure 16-16 mm. Tête (Pl. I, fig. 3), thorax et abdomen d'un beige clair. Palpes labiaux blancs : le deuxième article, parsemé dorsalement d'écailles beiges, est à peu près aussi long que le diamètre de l'œil et 1,5 fois plus long que le troisième article. Antennes, dépourvues de touffe de poils à la base, totalement blanches. Ailes antérieures de couleur beige uniforme, rayées de lignes argentées : la première se trouve le long de la costa, de la base jusqu'au début des franges ; une tache allongée, séparée en deux parties, se trouve au niveau de la cellule le long de la nervure m_1 ; la deuxième ligne est placée sur la nervure cu_1, en partant de la base, elle s'arrête avant le bord de l'aile ; la troisième ligne se trouve sur le dorsum et se termine avant les franges. Franges de couleur gris beige clair. Ailes postérieures brun clair, avec les franges d'un gris beige clair.

Genitalia mâles (Pl. IV, fig. 13) : Gnathos petit, globuleux. Tegumen petit, rétréci au milieu, pourvu de deux bras longs et aplatis. Transtilla petite, courbe, subtriangulaire. Valvula petite, très sclérifiée, hérissée de poils minces : la partie ventrale est courbe, en forme de goutte. Sacculus avec le bord ventral courbe très sclérifié, présentant une dent courte, trapue et émoussée dans l'angle ventro-caudal, tandis que dans l'angle dorso-caudal on voit une protubérance en forme de corne trapue, courbe, dentelée latéralement. Édéage long et courbe, caractérisé par

PLANCHE IV

Fig. 13. *C. persana* sp. n. : genitalia mâles (holotype).
Fig. 14. Idem : abdomen.
Fig. 15. Idem : valve, sacculus et édéage grossis.
Fig. 16. Idem : cornuti très grossis (holotype, PG Bldz 5424).
Fig. 17. Idem : (paratype, PG Bldz 5726).

deux baguettes sclérifiées, dont la plus longue se termine en forme de bec, courbe et aiguë à l'apex, tandis que la plus courte se termine en forme de crochet. Les cornuti, nombreux (plus de 15) et de longueurs différentes, sont réunis dans une structure très longue, dilatée à la base.

Structures de renforcement de l'abdomen (Pl. IV, fig. 14) : Pas de barres latéro-postérieures ; la transversale est presque droite avec le bord distal plus épais. Disques tergaux (3ème tergite), hérissés d'épines coniques très courtes, à peu près 3 fois plus longs que larges.

Remarque : L'espèce, dont la femelle et la biologie sont inconnues, doit être placée auprès de *C. psamata* Falkovitsh, espèce qui peut être séparée par les caractères suivants des genitalia mâles : ceux de *persana* ont une structure plus allongée ; l'édéage est plus étroit et plus long ; le sacculus est plus allongé et le bord latéral est bien plus courbe, alors que l'angle ventro-caudal est moins nettement évident.

Répartition géographique : Iran septentrional.

C. walsinghami sp. n.

Holotype ♂ (PG Bldz 2217) portant les étiquettes suivantes : 1) «Césarée», 2) «1920-1932 coll. L. & J. De Joannis Muséum Paris», 3) «3302, WLSM. 1898», 4) «*Coleophora punctulella* Wlsm. Type ♂», coll. MNHN.

Lorsque j'ai trouvé cet exemplaire dans la collection L. & J. de Joannis au MNHN, j'ai découvert que le nom «*punctulella*» était *in litteris*. Le Dr Sattler a recherché ce nom dans le «notebook» de Lord Walsingham, qui est conservé au BMNH, et a retrouvé la date et le numéro que Walsingham avait écrit sur l'une des étiquettes de l'exemplaire en question lorsque il l'avait examiné. Dans ce «notebook», il existe une esquisse en couleurs de Durrant et une description sommaire avec une remarque qui dit : «In bad condition — this is only a sketch, not a finished drawing. Drnt.». J'ai donc décidé de décrire cette espèce, mais avec le nom de *walsinghami* et non sous celui de «*punctulella*», car il pourrait être confondu avec le *C. punctulatella* de Zeller, 1849. Il faut remarquer que l'exemplaire n'est pas en si mauvaise condition ; il est seulement mal étalé.

Diagnose : Envergure 14 mm. Tête (Pl. I, fig. 2) couleur crème. Antennes, dépourvues de poils à la base, de couleur blanc sale uniforme. Palpes labiaux couleur crème : le deuxième article est à peu près 0,5 fois plus long que le troisième et que le diamètre de l'œil. Ailes

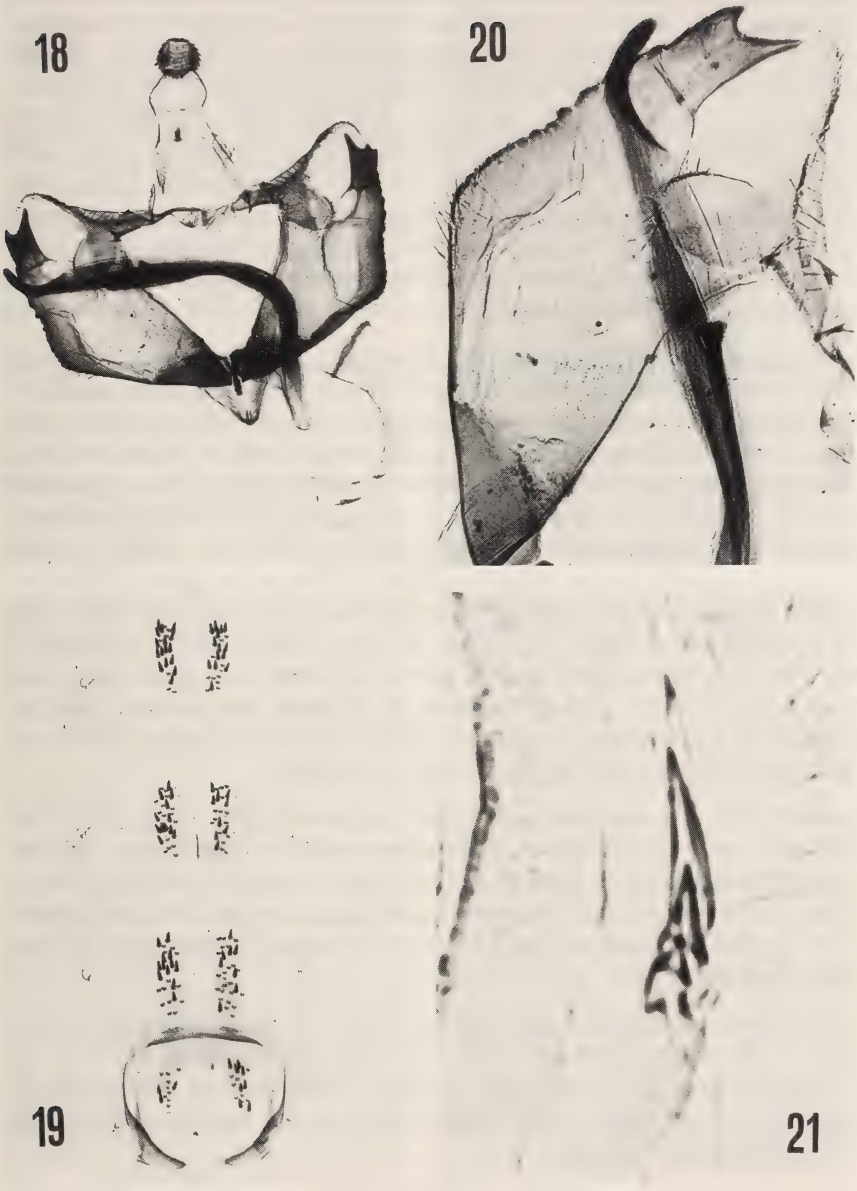

Planche V

Fig. 18. *C. walsinghami* sp. n. : genitalia mâles.
Fig. 19. Idem : abdomen.
Fig. 20. Idem : valve, sacculus et édéage grossis.
Fig. 21. Idem : cornuti très grossis.

antérieures de couleur ocre clair parsemées de quelques écailles brunes, qui forment un point brun foncé dans la cellule ; des lignes longitudinales argentées se trouvent sur la surface des ailes : la première le long de la costa, en partant de la base, s'arrête vers les 3/4, au début des franges ; la deuxième ligne est mince à la base, puis s'élargit aussitôt pour atteindre les 2/3 de l'aile en courant sur la nervure cu_1 ; une petite tache argentée oblongue se trouve entre ces deux lignes près de la tache brune de la cellule ; la troisième ligne, très mince, est placée le long du dorsum et, en partant de la base, atteint l'origine des franges. Les franges sont gris jaune clair. Ailes postérieures gris clair, avec les franges d'un gris jaune clair.

Genitalia mâles (Pl. V, fig. 18) : Gnathos petit, globuleux. Tegumen étroit avec deux bras étroits et allongés. Transtilla aplatie subtriangulaire. Valve courte et trapue en forme d'oreille. Valvula très sclérifiée, avec une région dorsale large, hérissée de soies minces et une région ventrale oblongue. Sacculus grand, avec le bord latéral très sclérifié et légèrement dentelé, se terminant dans l'angle dorso-caudal par un long processus surmonté de deux dents aiguës de longueur différente. Édéage courbe et allongé, caractérisé par deux bandes sclérifiées de longueur différente : la plus longue, élargie dans sa partie médiane, se retrécit à l'apex, qui est courbe, très sclérifié, en forme de corne émoussée ; la seconde, à peu près 1/5 plus courte que la première, porte une petite dent subtriangulaire vers les 3/4 en partant de la base. Les cornuti sont au nombre de 4, très petits, de forme triangulaire et de longueur différente, réunis dans une formation semblable à une épine.

Structures de renforcement de l'abdomen (Pl. V. fig. 19) : Pas de barres latéro-postérieures, celle transversale est légèrement courbe, avec le bord proximal épais et le bord distal constitué par deux demi-lunes à la base des disques tergaux du deuxième tergite. Disques tergaux (3ème tergite), hérissés de petites épines coniques, à peu près 3,5 fois plus longs que larges.

Remarque : L'espèce, dont la femelle et la biologie sont inconnues, appartient certainement au groupe de *C. attalicella*, mais par suite de la structure très particulière des genitalia mâles, il m'est impossible de la rapprocher de quelque autre espèce déjà connue, surtout par la forme du sacculus et de l'édéage.

Répartition géographique : Suivant les notes trouvées dans le «notebook» de Walsingham, l'exemplaire a été recueilli à Césarée de Syrie.

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Beitrag zur Verbreitung und Taxonomie von *Agriphila brioniella* (Zerny, 1914) und *A. latistria* (Haworth, 1811) (Lepidoptera, Pyralidae, Crambinae)

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Summary

Data are reported on the geographical distribution of *Agriphila brioniella* (Zerny, 1914) and *A. latistria* (Haworth, 1811). *A. vasilevi* Ganev, 1983 and *A. asiatica* Ganev & Hacker, 1984 are synonymized with *A. brioniella*. The taxon *vallicolella* (Costa, 1885) is considered to be only a form of *A. latistria* as it occurs throughout the range of the species and cannot be distinguished on the basis of genital, ecological or phenological characters.

Agriphila brioniella (Zerny, 1914)

Ann. Hofmus. Wien 28 : 298. Locus typicus : Istrien, Brioni (Abb. 1-25).

Agriphila vasilevi Ganev, 1983. Nota lepid. 6 : 210-213. **Syn. n.** Locus typicus : Bulgarien, Zentral-Rhodope, Gegend Halpatsch, nordwestlich von Tschepalare, 900 m.

Agriphila asiatica Ganev & Hacker, 1984. Nota lepid. 7 : 238-241. **Syn. n.** Locus typicus : Türkei, Prov. Adana, 6 km N. Feke, 1100 m.

Die geographische Verbreitung und taxonomische Gliederung der Art *brioniella* ist immer noch nur lückenhaft bekannt. Bleszynski (1957) behauptet : „*A. brioniella* (Zerny) is a Mediterranean species reaching its northern border of distribution in Hungary". Er erwähnt sie von Ungarn auch in seiner zusammenfassenden Arbeit über die Paläarktis (Bleszynski, 1965). Diese Angaben sind jedoch verfehlte Interpretationen der von Szent-Iványi und Uhrik-Mészáros (1942) mitgeteilten Fundort-Angaben. Die Art wurde von diesen Autoren nämlich aus dem Gebiete des heutigen Rumänien erwähnt (Fundort : Borosjenő und Herkulesfürdő). Das Vorkommen von *brioniella* ist auf dem Gebiet des derzeitigen Ungarns noch nicht belegt. Geographische Verbreitung : Kleinasien, Transkaukasien, Halbinsel Krim, Balkanhalbinsel (Bulga-

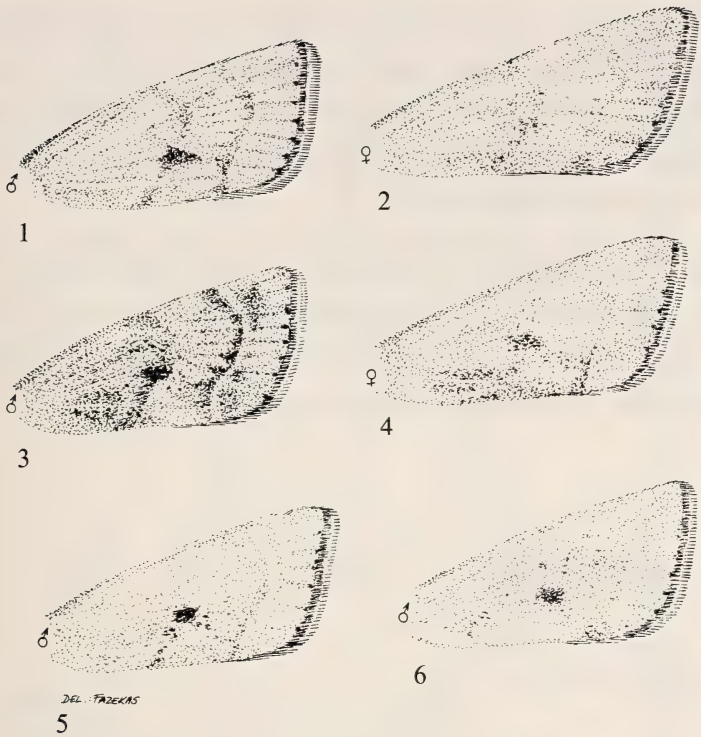

Abb. 1-6. *Agriphila brioniella* (Zerny), rechte Vorderflügel : 1. Jugoslawien : Brioni (Lectotype) ; 2. Jugoslawien : Brioni ; 3. Jugoslawien : Sansego, Küstenland ; 4. Zypern : Limassol ; 5. Sizilien : Madonie ; 6. Albanien : Kruma.

rien, Albanien, Jugoslawien, Rumänien), Zypern, Sizilien, Italien und Süd-Frankreich.

In der einschlägigen Literatur gibt es nur wenige Angaben über die starke Variabilität der morphologischen Merkmale sowie der Genitalien von *brioniella*. Die Typen der Art sind nur in der Originalbeschreibung abgebildet. Die Abbildungen in Bleszynski's Arbeiten (1957, 1965), auch jene der Genitalien, beruhen fast ausschliesslich auf italienischen Exemplaren, und repräsentieren eben deshalb nicht das vollkommene Bild des Taxons. Eine nur lückenhaft durchgeführte vergleichende Analyse der geographischen Variabilität von *brionella* führte zu der Beschreibung zweier neuer Arten : *A. vasilevi* Ganev und *A. asiatica* Ganev & Hacker.

A. vasilevi wurde nach einem einzige Männchen und *A. asiatica* nach einem Männchen und einem Weibchen beschrieben. Unterschiede

zwischen *A. vasilevi* und *A. brioniella* sind in der Urbeschreibung nur wenige angegeben: "Die Form der Valve wie bei *brioniella*, jedoch etwas länger. An der Basis breiter als bei *brioniella*. Saccus breiter. Aedoeagus so lang wie die Valve, Form wie bei *A. paleatella*. Cornuti 1/2 länger als bei *brioniella*". *A. asiatica* soll von *A. brioniella* hauptsächlich durch die Zahl der Cornuti (23) und in der Form des Ductus bursae verschieden sein.

Nach einer vergleichenden Analyse der Typen sowie mehreren Exemplare, die aus verschiedenen Gebieten stammen, kann ich die angegebenen Unterschiede nur als normale Variationen innerhalb der Art *brioniella* betrachten. Deshalb erkläre ich die Taxa *Agriphila vasilevi* Ganev, 1983 und *Agriphila asiatica* Ganev & Hacker, 1984 für Synonyme der Art *Agriphila brioniella* (Zerny, 1914).

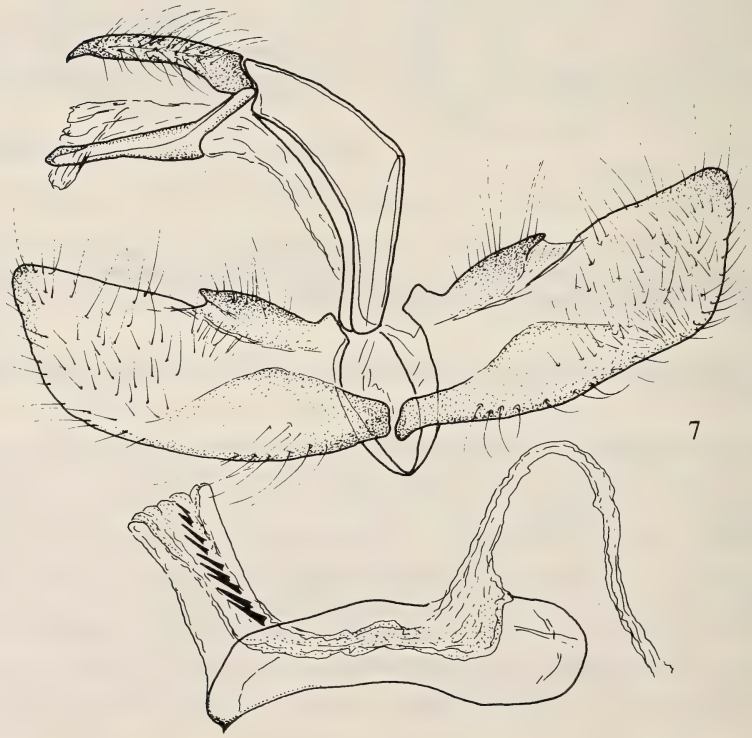

Abb. 7. Männlicher Genitalapparat von *Agriphila brioniella* (Zerny) (Lectotype), Jugoslawien: Brioni, GP Fazekas Nr. 2230.

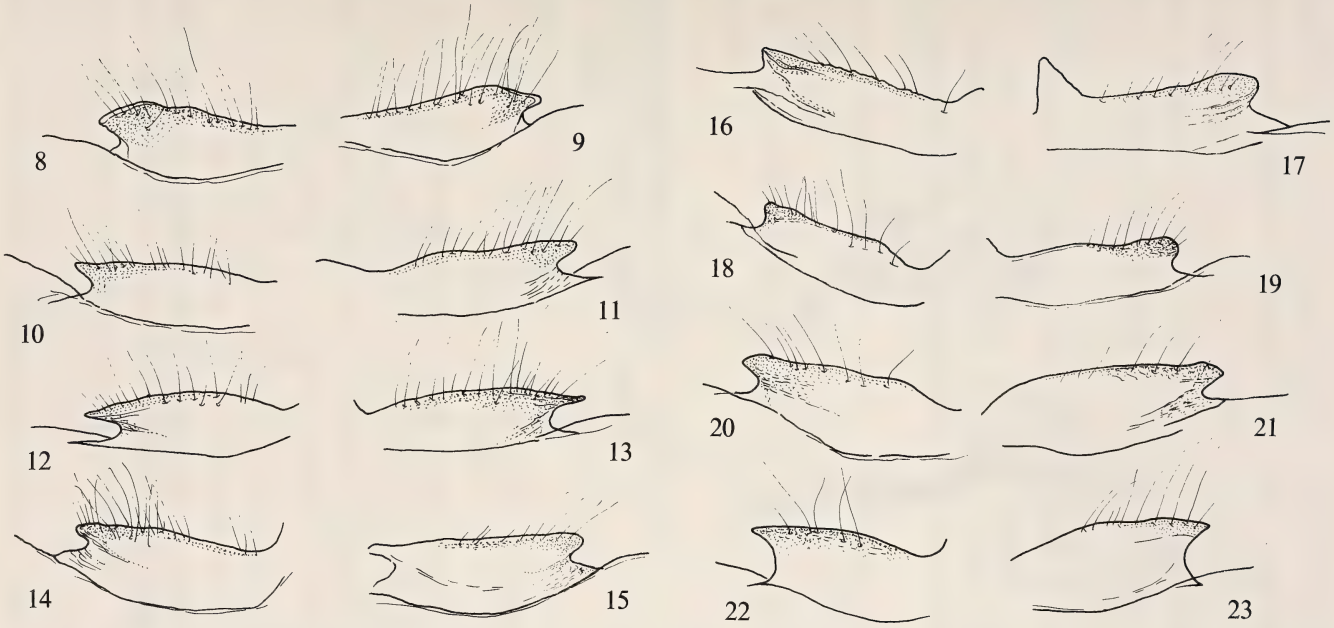

Abb. 8-23. Costalarm (männliche Genitalapparat) von *Agriphila brioniella* (Zerny) : 8-9. Jugoslawien : Istria ; 10-11. Jugoslawien : Zengg ; 12-13. Jugoslawien : Knin ; 14-15. Jugoslawien : Insel Lissa Comisa ; 16-17. Jugoslawien : Neu Montenegro, Zljeb Penth ; 18-19. Albanien : Kruma ; 20-21. Sizilien : Mezzojuso ; 22-23. Sizilien ; Madonie, Petralia Sottana.

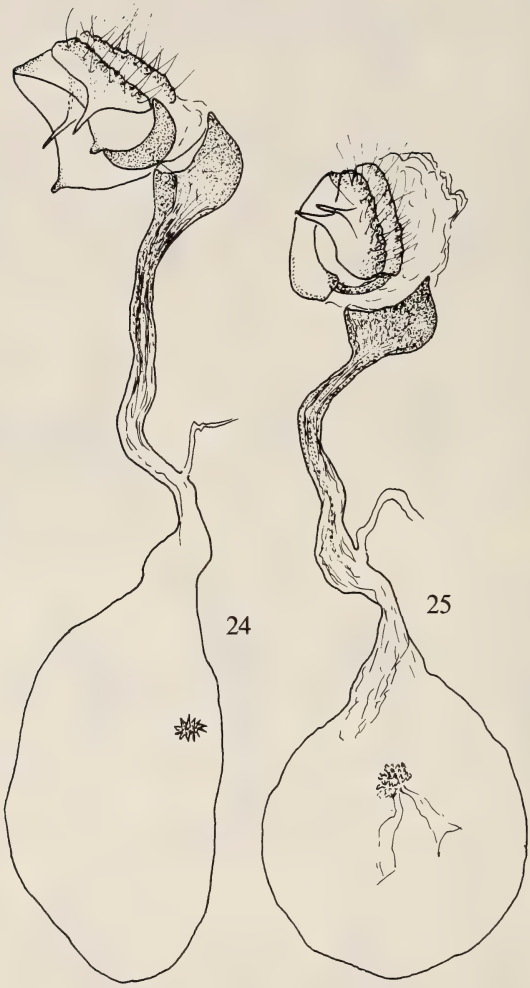

Abb. 24-25. Weiblicher Genitalapparat von *Agriphila brioniella* (Zerny) : 24. Jugoslawien ; Brioni (Paralectotype), GP Fazekas Nr. 2231 ; 25. Zypern : Limassol, GP Bleszynski Nr. 3710.

Beschreibung : Spannweite 20-28 mm. Stirnkegel abgerundet oder auffallend spitz hervorspringend. Palpus labialis gräulich und dunkelbraun gefleckt. Farbe des Kopfes, Thorax und Hinterleibes weiss und gelb in verschiedenem Grade miteinander gemischt. Grundfarbe des Vorderflügels von weisslich-gelb durch blassgelb bis zu bräunlich-gelb in allen möglichen Farbtönen. Querlinien manchmal kräftig hervortretend, ein anderes Mal aber blass (Abb. 1-6) ; manchmal verschwinden sie völlig. Der Fleck unter der Zelle meistens verbleibend, es gibt jedoch Exemplare, die völlig frei von einer Zeichnung sind. Hinterflügel weisslich schimmernd, auf seinem Apex gräulich, oder bräunlich eingestreut.

Männliche genitalien (Abb. 17-23) : Stark variabel. Der obere Rand der Costalarm der Valva gerade, konvex oder wellenförmig, apikalswärts spitz auslaufend, ausgekerbt oder abgerundet. Zahl der Cornuti im Aedoeagus 8-23.

Weibliche genitalien (Abb. 24-25) : Apophyses posteriores kurz ausgezogen oder abgerundet. Bursa des Ostium kegelförmig, Ductus bursae sklerotisiert, an seiner Basis manchmal jedoch erweitert. Gestalt der Bursa copulatrix weitgehend von der Fixierung des Präparates abhängig.

Agriphila latistria latistria (Haworth, 1811)
Lep. Brit. : 485. Locus typicus : "England"
(Abb. 26-38).

Agriphila latistria vallicolella (Costa, 1885).
Bull. Soc. ent. Ital. 17 : 252. **Syn. n.** Neotypus male : "Sardinia, Gennargentu, Aritzo, 16.IX. Geo. C. Kruger". In coll. Nat. Hist. Mus. Wien.

Die Art ist von Mesopotamien durch die Balkanhalbinsel sowie Mittel- und Westeuropa (einschliesslich der Britischen Inseln) im mediterranen Raum sowie in Nordafrika verbreitet. Ihr Areal ist jedoch diskontinuierlich. Das Vorkommen der Art konnte in mehreren Ländern bisher nicht belegt werden ; aus Ungarn wurde sie irrtümlich gemeldet (Bleszynski, 1965 : 244). Innerhalb Ungarns derzeitigen Staatsgrenzen wurde sie noch nicht gefunden (vgl. Szent-Ivány & Uhrik-Mészáros, 1942 : 123). In der Umgebung des Karpatenbeckens kommt die Art nur in Slovenien und im Burgenland vor.

Die Art *latistria* zeichnet sich durch eine starke Variabilität aus. Bisher war nur eine Unterart beschrieben, *vallicolella* von Sardinien. Auf Sardinien wurden jedoch nicht nur *vallicolella* entsprechende Formen gesammelt, sondern auch solche, die sich mit der Nominatform als identisch erwiesen haben. Andererseits kommen auf der Halbinsel

Istrien und in anderen Gebieten des Mediterraneums Exemplare neben der Nominatform vor, die einen dem der *vallicolella* völlig identischen Habitus zeigen. Querstreifen, die für *vallicolella* bezeichnend sind, können — wenn auch etwas blassere — auch an britischen Exemplaren beobachtet werden. Ähnlich dem Habitus der Tiere weisen auch die Genitalien extreme individuelle Variationen auf (Abb. 30-38), vor allem hinsichtlich der Gestalt des Costalarmes der Valva sowie der Zahl und Grösse der Cornuti.

Aufgrund eines Vergleiches von Serien, die von verschiedenen geographischen Gebieten stammen, lässt sich feststellen, dass *vallicolella* in sämtlichen Populationen auftreten kann ; *vallicolella* besitzt kein selbständiges Areal, es ist unmöglich sie aufgrund des Baues der Genitalien, ihrer morphologischen Merkmale sowie Phänologie eindeutig zu charakterisieren. Das Taxon *vallicolella* Costa, 1885 muss deshalb als infrasubspezifisch (Form) betrachtet werden.

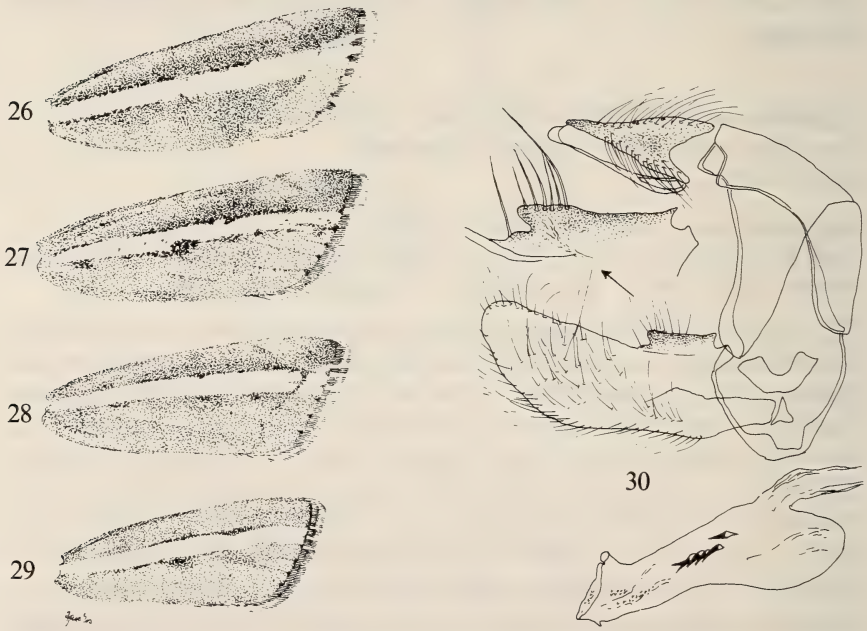

Abb. 26-29. *Agriphila latistria* (Haworth), rechte Vorderflügel : 26. England : London ; 27. Sardinien : Aritzo ; 28. Jugoslawien : Istria, Sansego ; 29. Jugoslawien : Dalmatien, Gravosa.
Abb. 30. Männlicher Genitalapparat von *Agriphila latistria* (Haworth), England : London, GP Fazekas Nr. 2245.

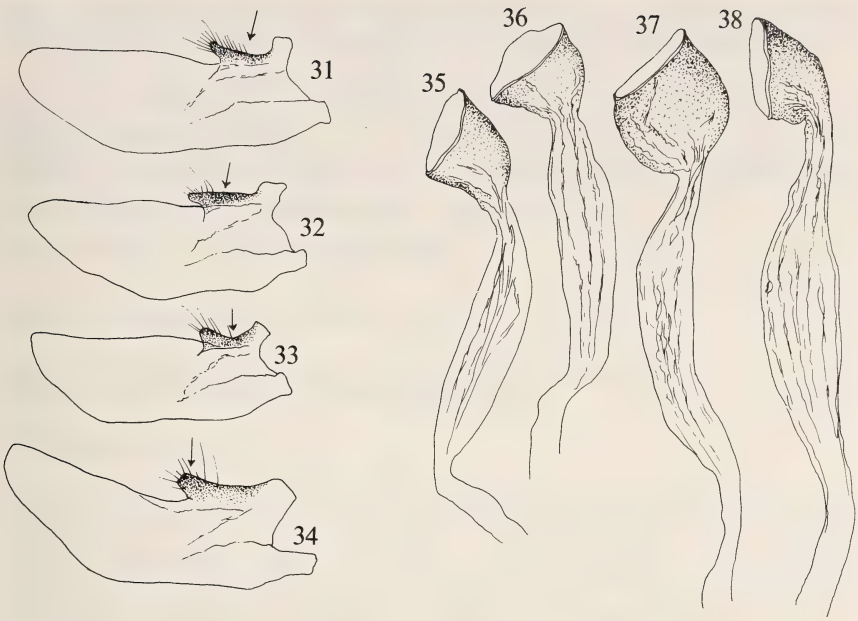

Abb. 31-34. Valva (männlicher Genitalapparat) von *Agriphila latistria* (Haworth) : 31. Jugoslawien : Istria ; 32. Jugoslawien : Gravosa ; 33. Sardinien : Aritzo ; 34. Österreich : Burgenland. GP Fazekas Nr. 2235, 2253, 2249, 2248.
Abb. 35-38. Ostium-Tasche und Ductus bursae (weiblicher Genitalapparat) von *Agriphila latistria* (Haworth) : 35. Spanien : Pityusen, Ibiza ; 36. Gibraltar : Algeciras ; 37. Syrien : «Syria 92. coll. Rebel» ; 38. Spanien : Albarracin. GP Fazekas Nr. 2250, 2251, 2247, 2252.

Dank

Ich möchte dem Herrn Dr. Martin Lödl (Nat. Hist. Mus. Wien) meinen besten Dank aussprechen, da er mir eine vergleichende Untersuchung der Typenexemplare sowie verschiedener Serien ermöglicht hat.

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Nota lepid. 13 (2-3) : 129-132 ; 30.IX.1990 ISSN 0342-7536

Exzeptionelle und partielle Parthenogenese bei Heterogyniden. Beschreibung der ersten Larvalstände und des Weibchens von *Heterogynis andalusica thomas* Zilli, 1987 (Lepidoptera, Heterogynidae)

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Zusammenfassung

Für ♀♀ einer nordafrikanischen Heterogyniden-Population des Taxons *Heterogynis andalusica thomas* Zilli, 1987 konnten Beobachtungen gemacht werden, die mit hoher Wahrscheinlichkeit auf parthenogenetische Entwicklung schließen lassen. Allerdings scheint diese nicht bei allen ♀♀ einer Generation aufzutreten, sondern nur bei einem niedrigen Prozentsatz derselben. Ob partielle Jungfernzeugung über alle Generationen hinweg konstant auftritt oder azyklisch, müssen weitere Untersuchungen klären. Vermutlich sind jedoch abiotische Faktoren oder das Fehlen von begattungsfähigen ♂♂ Auslöser zur Entwicklung von Parthenoblasten. Beschrieben werden die L_1 bzw. L_2-Raupe des Taxon *thomas* Zilli, 1987 und die ♀♀.

Summary

Observations on living and dead female material of a Heterogynidae-population from North-Africa (*Heterogynis andalusica thomas* Zilli, 1987) show that partial or exceptional parthenogenesis is probable in the family Heterogynidae. A description of the female and the L_1 and L_2-larvae of taxon *thomas* is given.

Einleitung

Beobachtungen an lebendem bzw. abgestorbenem weiblichen Material einer nordafrikanischen Heterogynidae-Population (*Heterogynis andalusica thomas* Zilli, 1987) zeigen, daß bei der Familie der Mottenspinner (Heterogynidae) partielle (exzeptionelle) Jungfernzeugung (Parthenogenese) sehr wahrscheinlich ist.

Mitte Juni 1979 erhielt der Zweitautor aus Algerien stammende Gespinste zugesandt, die von C. Naumann, Bielefeld, in Nordalgerien,

Prov. Alger, Col de Ben Chicao, 1240 m am 6. Juni 1979 neben einer kleinen Serie von ♂♂ eingetragen worden waren.

Die Gespinste blieben zunächst einige Tage unbeachtet und wurden dann 9 Tage nach dem Auflesen im Lebensraum ihrer algerischen Heimat mechanisch mit Hilfe einer Schere durch Längsschnitt geöffnet. Dieses Öffnen diente dem Zwecke der Kontrolle, ob es sich um frisches, noch lebendes (eventuelle noch ungeschlüpfte Puppen) oder bereits abgestorbenes Material handelte. Die Feinstruktur der seidenglänzenden Gespinste deutete darauf hin, daß deren Verfertiger derselben Nachkommenschaft angehören mußten wie die im Freiland am 6.6.1979 gefangenen ♂♂, denn ältere, bereits abgestorbene und überjährige Gespinste verlieren in der Regel ihren Glanz und die lockere Gewebestruktur verklebt und verdichtet sich.

In den geöffneten Gespinsten fanden sich eigenartigerweise ausschließlich weibliche Individuen, in wenigen Exemplaren bereits tot und eingeschrumpft, in den meisten Fällen jedoch noch lebend. Männliche Puppen waren nicht darunter, was a) auf eine frühere Flugzeit der ♂♂ und b) vielleicht auf eine andere Nische als Verpuppungsort derselben schließen läßt. Möglicherweise befinden sich die männlichen Gespinste in Bodennähe, während die weiblichen Raupen ihre Gespinste, für das menschliche Auge deutlicher wahrnehmbar, an Grashalmen über dem Boden anfertigen.

Von besonderem Interesse ist, daß wir es bei den weiblichen Individuen anscheinend mit zwei unterschiedlichen Entwicklungsformen zu tun haben, eine Feststellung, die sich aus dem Untersuchungsmaterial ableiten läßt. Die ♀♀ in den Gespinsten lassen sich nämlich in zwei Gruppen unterteilen.

Danach gibt es zum einen ♀♀, die (völlig oder auch nur teilweise) aus der Puppenhülle schlüpfen, um dann im Gespinst von den ♂♂ begattet, darin auch ihren Eiervorrat ablegen.

Andere ♀♀ derselben Population streifen dagegen weder die Puppenhülle ab, noch verlassen sie das Gespinst. Diese ♀♀ (3 Exemplare; im Gegensatz hierzu 16 ♀♀, die die Puppenhülle ganz oder teilweise abgestreift hatten und an deren Legeöffnung sich eine unterschiedliche Anzahl unbefruchteter Eier befand) scheinen keine Eier zu legen. Beim Öffnen des Gespinstes stößt man zunächst auf eine unbeschädigte und damit völlig geschlossene Puppenhülle, in der sich aber eine große Zahl von Eiraupen entwickelt, die sich zunächst im und vom Körper des Muttertieres ernähren (nekrophage Phase), um im weiteren Entwicklungszyklus die Puppenhülle benagen, sie durchstoßen, um sich schließ-

lich an der Futterpflanze weiterzuernähren (phytophage Phase). Diese unterschiedliche Biologie läßt das Vorhandensein parthenogenetischer Entwicklung bei einem geringen Prozentsatz der ♀♀ als sehr wahrscheinlich erscheinen.

Zuchtbericht

Vorneweg die unbefriedigende Tatsache, daß die Zucht nur bis zum Beginn des L_2-Stadium gelang. Dennoch konnten aus der mißglückten Zucht neue Erkenntnisse über die Biologie der Art und die Phänologie der Raupe im L_1 und L_2-Stadium gewonnen werden.

Den von den 3 ♀♀ stammenden 179 Eiraupen wurden nach Öffnung und Verlassen des Muttertieres versuchsweise verschiedene Ginsterarten angeboten, von denen sie schließlich die schmalen Blätter eines gelb blühenden Strauchginsters zögernd annahmen. Erschwert wurde die Zucht dadurch, daß die Raupen ohne Sonnenbestrahlung nicht fraßen, andererseits aber bei Sonneneinstrahlung spontan die hellste Stelle des Zuchtbehälters aufsuchten, ohne sich dann dabei der Nahrungsaufnahme zu widmen. Das war letztenendes die Hauptursache für das Scheitern der Zucht, wohl im Bewußtsein der Tatsache, daß auch die Unkenntnis um die eigentliche Futterpflanze und das nur widerwillig angenommene Ersatzfutter die Zucht negativ beeinflußten. Nach Beobachtung von Naumann (mündl. Mitt.) ist im Biotop am Col de ben Chicao eine *Onobrychis*-Art (Leguminosae) üppig vorhanden, die als mögliche Futterpflanze in Betracht zu ziehen ist.

Beschreibung der ersten Raupenstadien

Eiraupe 2,3 mm lang, im erwachsenem L_2-Stadium 4 mm. Grundfärbung hell gelbgrau, Kopf dunkler grau. Segmenteinschnitte ebenfalls grau, dorsal noch etwas dunkler grau. Kopf mit feiner, kurzer Beborstung, Segmente mit acht kleinen, schwarzen, kurzbehaarten Warzen (davon lateral vier) besetzt. Das 1., 2. und 3. Segment sowie das 6., 7., 8. und 9. mit je einem Beinpaar.

Die Raupe im 2. Stadium ist zu Anfang 6 mm lang, der Kopf ist graubeige, die Mundwerkzeuge sind bereits stark sklerotisiert. Die Grundfärbung ist nach wie vor schmutzig graugelb, jedoch durch die Nahrungsaufnahme etwas weniger transparent.

Die schwarzen Warzen sind nun auffallend knopfartig erhaben und massiver, die Behaarung im Vergleich zur Eiraupe deutlich länger.

Beschreibung des Weibchens
von *Heterogynis andalusica thomas* Zilli, 1987

Zilli beschrieb 1987 nach Tieren, die ebenfalls vom Col de Ben Chicao stammen, das Taxon *thomas* im Artrang. Nach jüngster Untersuchung der Verfasser zeigen die Tiere aber sehr viel Übereinstimmung mit *Heterogynis andalusica* Daniel, 1966, (dessen Typenmaterial Zilli 1987 zum Vergleich nicht zur Verfügung stand), so daß *thomas* Zilli, 1987 wohl besser als Unterart von dieser einzustufen ist (vgl. de Freina & Witt, 1990 : 87). Die *thomas*-Typenserie beinhaltet auch 2 ♀♀ exemplare, deren Beschreibung bzw. Differentialdiagnose zu *H. penella* von Zilli (1987 : 40) jedoch unterblieb. Die ♀♀ aus Nordalgerien unterscheiden sich sehr deutlich von typischen *penella*-♀♀. Im Gegensatz zu diesen sind sie nicht so schlank, dafür deutlich kürzer und tönnchenförmiger, caudad verbreitert. Kopf und vordere Beine hell gelblich (bei *penella* sind diese schwarzbraun), die Bauchbeine verkümmert. Grundfärbung milchig trübweiß, dorsaler feiner Mittelstreifen zimtfarben, an den Segmenteinschnitten mit feiner kurzer, ebenso gefärbter Querlinierung, im Gegensatz hierzu eine breite, schokoladenbraune, dorsale Wellenbinde bei *penella*. Im Übergang zum lateralen Bereich jeweils ein weiteres feines Zackenband, sublateral an jeder Seite ein doppeltes Zackenband. Ventral vom Kopf bis zur Bauchmitte ein sich nach hinten verlierendes Band von gleicher Färbung. Eine farbige Abbildung beider Geschlechter erfolgt bei de Freina & Witt (1990) : Tafel 10, sowie S. 79, Abb. 44-52.

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On the identity of *Annickia alpicola* Gibeaux, 1990 (Lepidoptera, Tineidae, Gracillariidae)

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Summary

The monotypic genus *Annickia* Gibeaux, 1990, recently described in the Tineidae (Meessiinae) is transferred to the Gracillariidae and synonymized with *Callisto* Stephens, 1834. *A. alpicola* Gibeaux, 1990, is a new synonym of *C. coffeella* (Zetterstedt, 1839).

Zusammenfassung

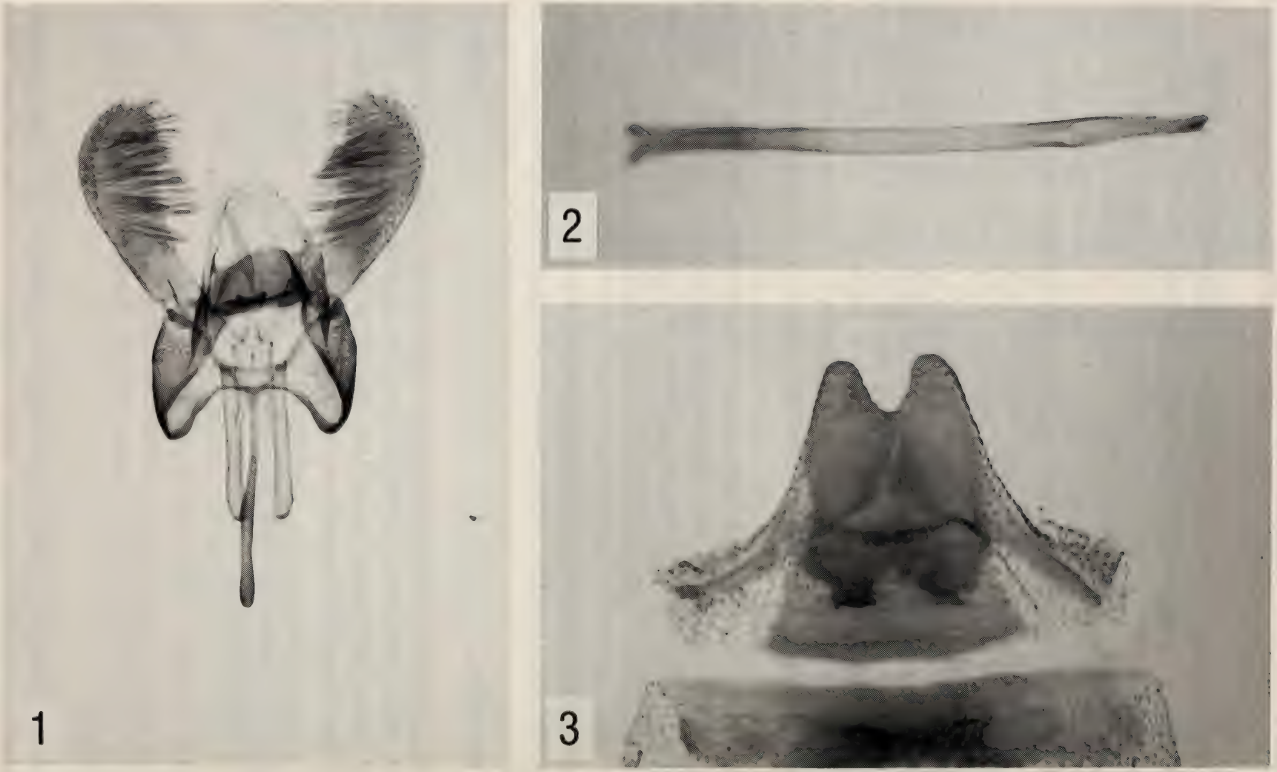
Die neulich in den Tineidae (Meessiinae) beschriebene Gattung *Annickia* Gibeaux, 1990, wird zu den Gracillariidae überführt und mit *Callisto* Stephens, 1834, synonymisiert. *A. alpicola* Gibeaux, 1990, ist ein neues jüngeres Synonym von *C. coffeella* (Zetterstedt, 1839).

The lepidoptera fauna of Central Europe is one of the best known in the world and therefore new species are rarely found. Every candidate for a description has to be studied with due suspicion to avoid possible new synonymies.

Recently, a new taxon has been described in the family Tineidae from a single male specimen taken in the French Alps (Gibeaux, 1990). Having consulted specialists of this family, neither of whom knew the species, nor its generic position, it was described as a new genus and species : *Annickia alpicola*. Unfortunately it was not recognized that the discussed taxon in fact belongs to the Gracillariidae where it is simply a new synonym.

Callisto Stephens, 1834, Illustrations of British Entomology (Haustellata) 4 : 276. Type species : *Tinea denticulella* Thunberg, 1794, D. D. Dissertatio Entomologica sistens Insecta Svecica 7 : 97, by original designation.

Annickia Gibeaux, 1990, Entomologica gallica 2 : 23. Type species : *Annickia alpicola* Gibeaux, 1990, *ibidem* 2 : 23, by original designation and monotypy. **Syn. n.**



Figs. 1-3. *Callisto coffeella* (ZETTERSTEDT), male genitalia. 1 : genitalia. 2 : aedeagus. 3 : sternum VII. Austria, Teriol sept., Vent 2000 m, e.l. 1.3.1956, leg. BURMANN (TIN 4).

Callisto coffeella (ZETTERSTEDT, 1839), Insecta Lapponica : 1009 (*Oecophora*).

Callisto interruptella (ZETTERSTEDT, 1839), Insecta Lapponica : 1009 (*Oecophora*) (Synonymized with *coffeella* by BENANDER, 1940 : 61). *Callisto alpicola* (GIBEAUX, 1990), Entomologica gallica 2 : 23. **Comb. n., syn. n.**

A full generic and specific synonymy is not given.

Discussion

The genus *Callisto* includes 5 European species which can be distinguished both externally and in the genitalia. The supposed phylogenetic interrelationships of four species has been studied by KYRKI *et al.* (1984). Species of *Callisto* are particulary characterized by a long and slender aedeagus, a long and narrow saccus in the male genitalia and paired, finely dentate long and narrow signa in the females. *C. coffeella* has the following characteristics in the male genitalia : sternum VII indented at apex, posterior processes of the anellus united basally, aedeagus without spines at the tip (figs. 1-3). The description of *alpicola* is very precise and fits perfectly with the figures of the type material of *coffeella* (BENANDER, 1940 : 65, fig. 13) and with other illustrations of this species (e.g. KUZNETSOV, 1981 : 222, pl. 210, fig. 2, pl. 213, fig. 3).

DISTRIBUTION : *C. coffeella* shows an arctoalpine pattern of distribution and it has been recorded from Scotland, Norway, Finland, Sweden, Poland and USSR (Carpathian Mts. and adjacent uplands) and from Germany, Austria, Switzerland, Yugoslavia, Italy and France (Alps). The species was recorded from France by LERAUT (1977).

BIOLOGY and HABITAT : Larvae feed on *Salix spp.* first in leafmines on the lower surface, later feeding under a turned down edge of a leaf, similar to other species of the genus. The moth flies actively during sunshine, usually around sallow bushes in the subalpine and alpine zones. The habitat described by GIBEAUX (1990) is typical for this species.

Acknowledgements

I am indebted to Dr. M. LÖDL (Vienna) for help with literature and to Dr. G. TARMANN (Innsbruck) for helpful discussions.

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Biselachista brachypterella sp. n. (Lepidoptera, Elachistidae)

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Summary

A new *Biselachista* species near *B. trapeziella* (Stainton, 1849) has been found in the mountains of the Sextener Dolomites (northern Italy). The species differs from *B. trapeziella* in external appearance, but no constant differences in the genitalia could be found. *Biselachista brachypterella* is the first alpine elachistid species known to have a brachypterous female. The moth and its genitalia are described and illustrated and comparisons are made with the closely related *Biselachista trapeziella* and the very similar, but not related *Elachista heinemanni* Frey, 1866 (*immolatella* Zeller, 1868).

Zusammenfassung

Nachstehend wird eine neue, durch Brachypterie beim Weibchen auffallende, aus den Sextener Dolomiten (Südtirol, Norditalien) stammende *Biselachista*-Art aus der Verwandtschaft der *B. trapeziella* (Stainton, 1849) beschrieben. Äußerlich der *Elachista heinemanni* Frey, 1866 (*immolatella* Zeller, 1868) sehr ähnlich, weist die neue Art keine durchgreifenden, morphologischen Unterschiede zu *Biselachista trapeziella* (Stainton) auf. Es werden Zeichnungen der neuen Art von beiden Geschlechtern, deren Flügelgeäder und Genitalien sowie vergleichsweise diesbezügliche Abbildungen der verwandten *B. trapeziella* und Skizzen der Genitalien der sehr ähnlichen *Elachista heinemanni* Frey (*immolatella* Zeller) gebracht. Der Lebensraum der neuen Art wird durch eine grobe Skizzierung der floristischen Verhältnisse vorgestellt. Die ersten Stände blieben bisher unbekannt.

Einleitung

Gelegentlich mehrerer in den Jahren 1986-1989 unternommener Exkursionen in die nordexponierten lichten Lärchenbestände des Kreuzbergpasses (Passo di Montecroce di Comelico, 1630-1650 m) in den Sextener Dolomiten erhielt ich durch Kätschern in den reichlichen Gramineen- und Cyperaceenbeständen neben mehreren anderen Elachistidenarten regelmäßig auch die ♂♂ einer Art, die mich an *Elachista heinemanni* Frey (*immolatella* Zeller) erinnerten (Frey, 1866 ; 1870 ; Parenti, 1977 ; Traugott-Olsen & Schmidt Nielsen, 1977). Be-

mühungen, auch die ♀♀ dieser Art zu erhalten, blieben zunächst ohne Erfolg. Die ♂♂ bestimmte in der Folge Herr Traugott-Olsen als eine Form der *Biselachista trapeziella* (Stainton). Erst 1989 gelang es mir endlich, auch das ♀ dieser Art zu entdecken, wodurch schließlich Klarheit in die Angelegenheit gebracht werden konnte. Trotz der weitreichenden Übereinstimmung der Genitalien meines Materials mit denen der robusteren und gezeichneten *Biselachista trapeziella* (Stt.) muß — auch nach Ansicht meiner Berater — das Vorliegen einer noch unbeschriebenen Art angenommen werden. In den folgenden Zeilen soll diese nun unter dem Namen *Biselachista brachypterella* sp. n. vorgestellt werden.

Biselachista brachypterella sp. n.

Holotypus : ♂ mit der Bezettelung : Teriol. mer. Kreuzbg. Paß, 1700 m, 16.VII.1988, GU 4363, leg. et Coll. J. Klimesch.

Paratypen : 3 ♂♂ mit dem gleichen Fundort, 1600 m, 24.VII.1989, GU 4367, GU 4368, GU 4369, leg. et Coll. J. Klimesch.

Gleicher Fundort, 12.VII.1988, 5 ♂♂ ; 16.VII.1988, 10 ♂♂, 24.VII.1988, 3 ♂♂, leg. et Coll. Klimesch ; 24.VII.1989, 4 ♂♂, 11 ♀♀, GU 4370, 4371, 4372 leg. et Coll. Klimesch, 2 ♂♂, 1 ♀ 24.VII.1989, leg. Klimesch in Coll. Brit. Mus., London.

Weiteres Material wird in folgenden Museen deponiert : Nat. Mus. Wien, Landesmuseum Linz, Landesmuseum Innsbruck, ETH Zürich.

Expansion : ♂ 9.5-10.5 mm (Vdfl. Länge 4-5 mm) Fig. 1 ; ♀ 7-8.5 mm (Vdfl. Länge 3-4 mm), Fig. 2.

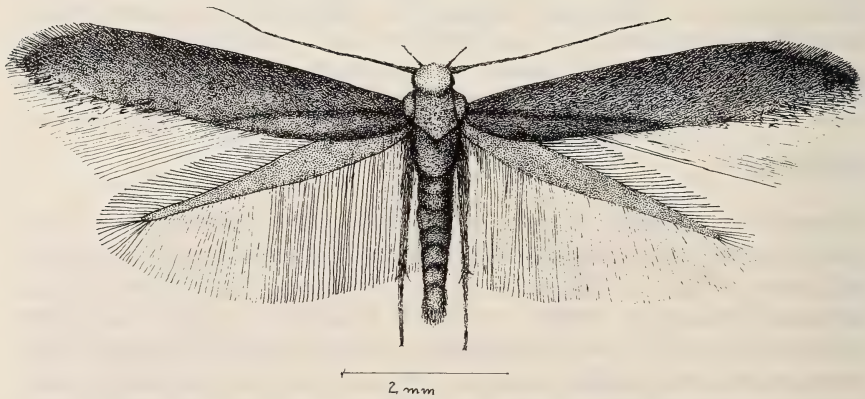


Fig. 1. *Biselachista brachypterella* sp. n. ♂, Teriol. mer., Kreuzberg Paß, 1650 m, 24.VII.1989.

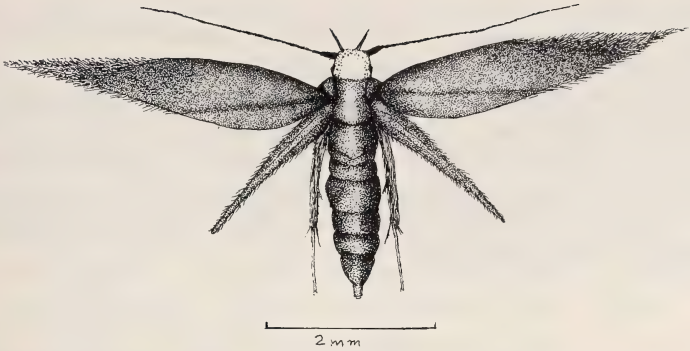


Fig. 2. *Biselachista brachypterella* sp. n. ♀, Teriol. mer., Kreuzberg Paß, 1650 m, 20.VII.1989.

Kopf bei ♂ und ♀ anliegend beschuppt, weißlich, seltener grau. Stirn weiß, zuweilen median grau getönt. Patagia weißlich, Tegulae, Thorax und Mesothorax ober- und unterseitig graubraun. Labialpalpen bei beiden Geschlechtern dünn, divergierend, leicht aufgebogen, anliegend beschuppt, weißlich bis hellgrau, das Mittelglied von ungefähr der doppelten Länge des Endgliedes. Rüssel rudimentär. Fühler graubraun, beim ♂ sägezähnig mit schwach vortretenden Ecken.

Abdomen beim ♂ schlank, oberseitig hell- bis dunkler braungrau entsprechend der Grundfarbe der Vdfl., mit gelblichem Analbusch. Das weibliche Abdomen plump, heller als das männliche, bräunlich mit gerundetem Analende. Beine bei beiden Geschlechtern oberseits hellgelblich bis grau, unterseits heller, die Hintertibien beim ♂ ober- und unterseits lang behaart, der innere Sporn etwa zweimal so lang wie der äußere.

Männliche Vorderflügel gestreckt, zeichnungslos, hell ockerfarben bis hellgrau, am Vorderrand und am Innenrand etwas dunkler, feinschuppig, matt glänzend, mit ebensolchen, nicht abgesetzten Fransen, in die am Innenrand einzelne, dunklere Schuppen eingestreut sind. Hinterflügel lanzettlich, hellgrau mit lichteren Fransen. Unterseite aller Flügel grau, gegen die Basis etwas dunkler.

Weibliche Vorderflügel : rückgebildet, schmäler als beim ♂, zugespitzt, grobschuppig, hellbräunlich bis dunkelgrau, am Innenrand und am Vorderrand etwas dunkler, zuweilen im Apex gelblich aufgehellt. Fransen von der Farbe der Vdfl., kürzer als beim ♂. Hinterflügel rückgebildet, stark verschmälert und zugespitzt, hellgrau. Fransen rudimen-

tär. Unterseite der Vdfl. grau, basal etwas dunkler. Geäder (Fig. 3, ♂, Fig. 4, ♀). Das Geäder entspricht dem Grundschema des Genus *Biselachista*. Beim ♀ ist die Vdfl — Fläche ungefähr ab der Mitte deutlich verkürzt und verschmälert. Im Geäder wirkt sich dies durch die Zusammendrängung und Verkürzung des Radius1-5, der Media 1 und 2, des Cubitus 1 und 2 und der Analis + Axillaris aus. Sehr auffällig ist die Flügelrückbildung im Htfl-Geäder : hier sind nur die Radial- und die Cubitalader vorhanden. Die Flügelreduktion bewirkt beim ♀ völlige Flugunfähigkeit.

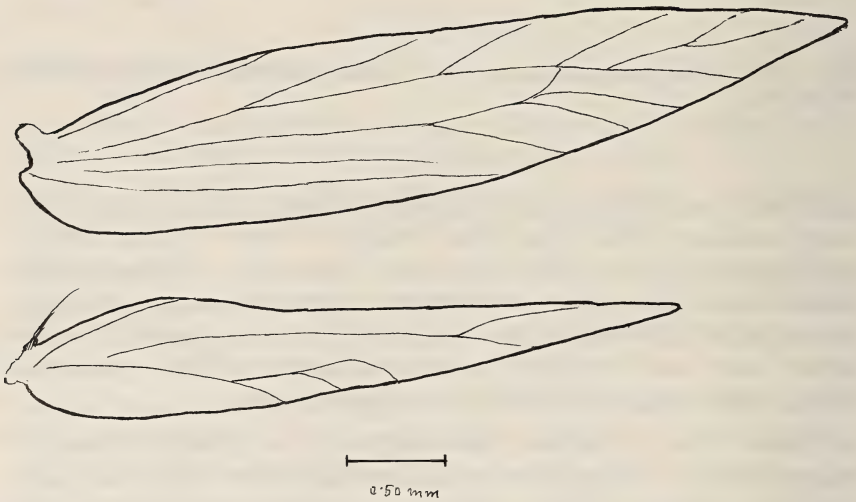


Fig. 3. *Biselachista brachypterella* sp. n. ♂, Geäder, Teriol. mer., Kreuzverg Paß, 1650 m, 12.VII.1988.

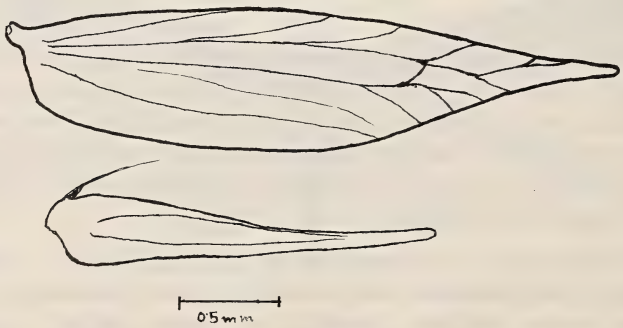
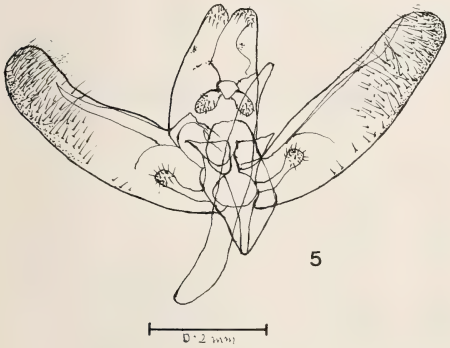


Fig. 4. *Biselachista brachypterella* sp. n. ♀, Geäder, Teriol. mer., Kreuzverg Paß, 1650 m, 24.VII.1989.

Männliches Genitale (Fig. 5) : Uncus eingekerbt, Uncuslappen kurz, apical mit kurzen Borsten besetzt. Gnathos zweilappig. Socii sehr klein, unscheinbar. Costa der Valven sklerotisiert, Vinculum dreieckig, Saccus fehlt, der fingerförmige Fortsatz gestreckt, keulenförmig. Am Apicalrand der Juxta einige kurze Borsten. Aedoeagus schlank, im Endteil längsverdickt.

Weibliches Genitale (Fig. 7) : Papillae anales kurz, gerundet, mit kurzen Borsten besetzt. Die Apophyses posteriores und die Apophyses anteriores ungefähr von gleicher Länge. Antrum kurz, schalenförmig, mit feinen Borsten im oberen Teil. Colliculum eng, schmal. Ductus bursae verbreitert, schwach sklerotisiert, daher ohne Färbung im weiteren Verlauf kaum sichtbar. Dies trifft auch beim Corpus bursae zu. Ein Signum fehlt.



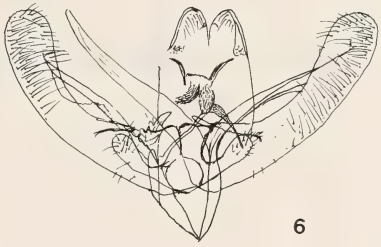


Fig. 5. *Biselachista brachypterella* sp. n., Männlicher Kopulationsapparat, Teriol. mer., Kreuzverg Paß, 1650 m, 16.VII.1988.
Fig. 6. *Biselachista trapeziella* (Stt.), Männlicher Kopulationsapparat aus Traugott-Olsen & Schmidt Nielsen (1977).

Diskussion

Unterschiede gegenüber der äußerlich sehr ähnlichen *Elachista heinemanni* Frey und der morphologisch verwandten *Biselachista trapeziella* (Stt.). Gegenüber *Elachista heinemanni* Frey bestehen folgende Unterschiede :

E. heinemanni ist deutlich robuster, breitflügeliger und grobschuppiger ; zuweilen treten auf den hell ockerfarbenen Vdfln Andeutungen einer bindenartigen Zeichnung auf. Das ♀ ist normal geflügelt. Das ♂ ist auf den ersten Blick auf Grund des Vorhandenseins eines ungeteilten

Gnathos (Fig. 10) als zum Genus *Elachista* gehörig zu erkennen, während bei der neuen Art der Gnathos zweigeteilt ist (Fig. 6), wie dies für *Biselachista* charakteristisch ist. Das *E. heinemanni* ♀ ist durch ein Signum in der Bursa copulatrix (Fig. 11) gekennzeichnet, bei *B. brachypterella* fehlt es jedoch (Fig. 7).

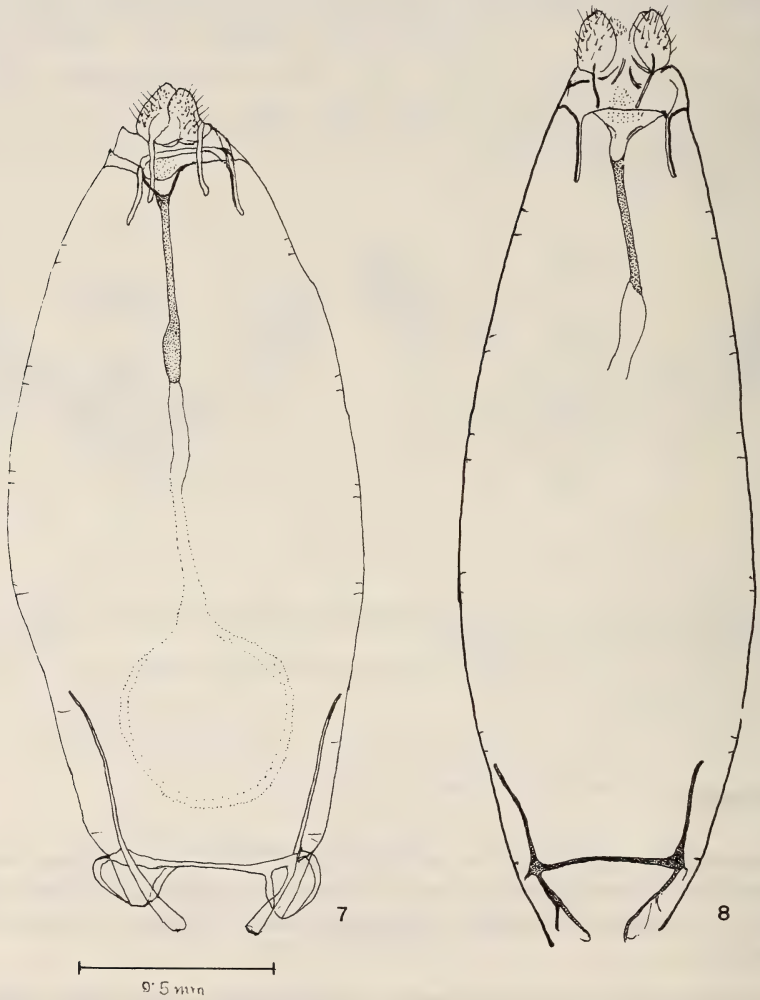


Fig. 7-8. *Biselachista brachypterella* sp. n. Weiblicher Kopulationsapparat Teriol. mer., Kreuzber Paß, 1650 m, 24.VII.1989 ; 8. *Biselachista trapeziella* (Stt.), Weiblicher Kopulationsapparat aus Traugott-Olsen & Schmidt Nielsen (1977).

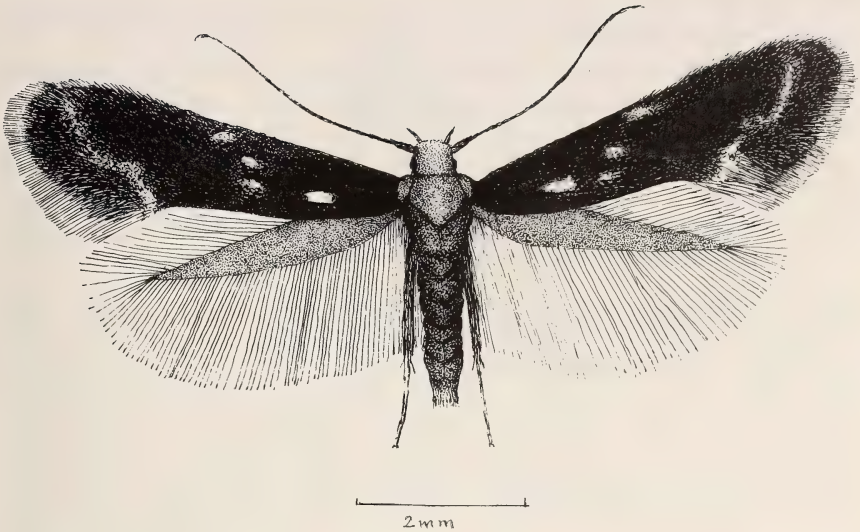


Fig. 9. *Biselachista trapeziella* (Stt.) ♂, Teriol. mer., Kreuzberg Paß, 1650 m, 16.VII.1988.

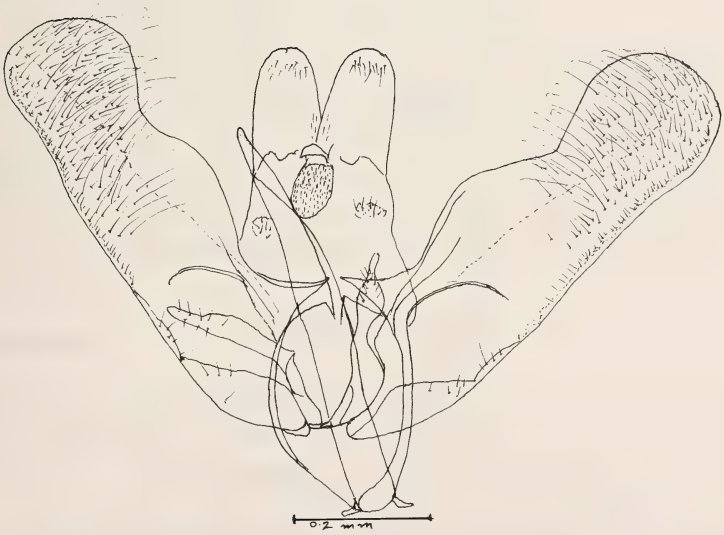


Fig. 10. *Elachista heinemanni* Frey, Männlicher Kopulationsapparat, Italia sept. (BL), Mte Zovo pr. Pádola, 1600 m, 26.VII.1986.

Fig. 11. *Elachista heinemanni* Frey, Weiblicher Kopulationsapparat, Italia sept. (BL), Mte Zovo pr. Pádola, 1600 m, 26.VII.1986.

Biselachista trapeziella (Stt.) ist ebenfalls robuster, breitflügeliger und weist auf schwarzbraunem Vdfl-Grund eine deutliche weiße Fleckenzeichnung auf (Fig. 9), die bei der f. *atavista* Groschke (1939) größere Ausmaße erreicht. Sie unterscheidet sich demnach in auffälliger Weise von der neuen Art. So unübersehbar die äußeren Unterschiede bei beiden Arten ausgeprägt sind, so sehr stimmen andererseits die Merkmale in morphologischer Hinsicht weitgehend überein. Erst die Auffindung des brachypteren ♀ der neuen Art hat die ursprünglich von Traugott-Olsen angenommene Artgleichheit widerlegen können.

Die Auffindung einer im weiblichen Geschlecht flugunfähigen Elachistiden-Art in alpinen Höhenlagen, in denen noch der Wald vorherrscht, legt die Vermutung nahe, daß die Kurzflügeligkeit in den hochalpinen, klimatisch rauhen Lagen erworben sein könnte, wie man dies auch bei einigen, in den hochalpinen Zonen heimischen Arten der Familien Gelechiidae, Yponomeutidae u.a. vermuten kann. Es wäre daher eine noch in Angriff zu nehmende Aufgabe, die Höhenverbreitung der neuen Art zu erkunden.

Lebensweise

Über die ersten Stände und deren Futterpflanzen können derzeit noch keine Angaben gemacht werden. Es besteht aber die Vermutung, daß die Raupe an Cyperaceen leben dürfte, da in deren Bereich die Imagines am späten Nachmittag (♂♂) und abends sowie am frühen Morgen (beide Geschlechter) durch Kätschern erbeutet wurden. Noch am frühen Morgen konnten ♂♂ und ♀♀ an den noch taunassen Gräsern — bereits getrennt nach der nächtlichen Copula — eingefangen werden. Die völlig flugunfähigen ♀♀ versuchen, sich beim Einfangen durch Hüpfen in Sicherheit zu bringen. Leider blieben Nachforschungen nach den ersten Spuren der zweifellos minierenden Raupen an den mutmaßlichen Substraten im Laufe des Herbstes (September - Anfang Oktober) bis jetzt erfolglos.

Lebensraum

Es sind lichte Lärchenbestände (Lärchen-Wiesenwald) in nordexponierten Hanglagen in ca 1600-1650 m Seehöhe im Gebiet der Sextener Dolomiten — Kreuzbergpaß — Passo di Montecroce di Comelico. Das Areal erscheint zum Unterschied des durch Beweidung und Mahd intensiv genutzten umgebenden Almbodens in jeder Hinsicht geschont, da es auch nicht von Touristenpfaden durchquert wird. Als Bodendecke herrscht überwiegend Grasflur auf alkalisch-neutralem Boden vor. Nach

RÜBEL (1912) und SCHARFETTER (1938) ist es als Deciduo-Laricetum pratosum anzusprechen und läßt sich floristisch folgendermaßen charakterisieren :

Baumschicht : Lärche mit einzelnen Fichten.

Strauchschicht : *Fagus silvatica*, sehr einzeln und ausnahmslos in verkümmerter Buschform ; *Sorbus chamaemespilus, Lonicera coerulea, Clematis alpina, Rosa pendulina* und *Daphne mezereum*. Hochstaudenflur : *Aconitum vulparia, Gentiana asclepiadis*. Krautschicht : *Carex* sp., *Deschampsia* sp., *Poa* sp., *Luzula* sp., *Alchemilla alpestris, Potentilla aurea, Trifolium montanum, Pulsatilla alpina, Trollius europaeus, Veratrum album, Lilium martagon, L. bulbiferum* (einzeln), *Gentiana cruciata*.

Dank

Für geleistete Unterstützung durch einschlägige Hinweise, Materialüberprüfung und Literaturbeschaffung sei den nachstehend genannten Herren auch an dieser Stelle noch herzlich gedankt :

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Les Lépidoptères de Madère
Note préliminaire :
Les Macrolépidoptères observés en mai 1989 (Lepidoptera, Geometridae, Sphingidae, Noctuidae, Papilionoidea)

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Résumé

Les résultats d'un séjour lépidoptérologique à Madère (2 semaines en mai 1989) sont communiqués. Quarante-quatre espèces de Macrolépidoptères ont été trouvées (14 Geometridae, 2 Sphingidae, 17 Noctuidae et 11 Papilionoidea), dont deux espèces nouvelles pour la faune de cette île (*Xestia c-nigrum* L. et *Ochropleura leucogaster* Frr.).

Summary

The results of a lepidopterological visit to Madeira (two weeks in May 1989) are given. Forty-four species of Macrolepidoptera are recorded (14 Geometridae, 2 Sphingidae, 17 Noctuidae and 11 Papilionoidea), two of which are new to the island : *Xestia c-nigrum* L. and *Ochropleura leucogaster* Frr.).

Introduction

Les îles océaniques n'ont jamais eu de contact direct avec le territoire continental et leurs biocénoses se composent donc d'organismes n'ayant pas pu atteindre ces territoires par voie terrestre. Pour un biogéographe, ces îles sont donc un sujet intéressant pour étudier les effets «insulaires». Mais, il y a encore un autre fait qui rend les îles océaniques importantes du point de vue scientifique : Certaines de ces îles n'ont été colonisées par l'homme que très récemment (quelques siècles) et les écosystèmes originaux occupent encore des surfaces relictaires, souvent non négligeables, ce qui n'est plus le cas sur le continent. Ainsi, les forêts de lauriers (Lauraceae) des îles Canaries et de Madère sont à considérer comme des vestiges de la végétation atlanto-méditerrannéenne, pratiquement détruite ailleurs.

La faune d'une telle île se compose :

— d'éléments anciens, souvent des taxons endémiques, démontrant une spéciation accentuée, due à l'absence d'échange génétique régulier avec les populations du continent,
— d'espèces migratrices non différenciées, ayant un échange génétique élevé avec le «pool» continental,
— d'espèces introduites récemment (volontairement ou involontairement) par l'homme.

Toute analyse de faunes insulaires doit tenir compte de ces trois catégories pour permettre d'interpréter correctement les taxocénoses inventoriées. Avant de pouvoir entrer dans ces analyses, une révision complète de la faune lépidoptérique de Madère s'impose, vu les nombreuses incertitudes remarquées pendant l'étude de la littérature spécialisée. Afin de permettre une première appréciation des résultats des recherches des auteurs, cette note préliminaire se limite à une simple liste des captures et observations des Macrolépidoptères. Une seule exception concerne l'«apparition» de *Pararge aegeria* à Madère, où des publications récentes (Oehmig, 1977, 1982, 1983, Owen *et al.*, 1986) rendent nécessaire une mise au point des considérations biogéographiques.

Résultats

Pendant un séjour de deux semaines (12.-25.5.1989) les auteurs ont eu l'occasion de faire des recherches lépidoptérologiques sur l'île de Madère. Les conditions climatiques très instables en dehors de la zone semi-aride (SE de l'île) rendent difficile la réalisation d'un plan d'excursions dans la zone montagnarde exposée aux vents et aux pluies du nord-est.

Néanmoins, à cinq reprises il fût possible d'utiliser le piège lumineux qui se composait de deux tubes luminescents (lumière «noire» et «superactinique»), branchés sur un transformateur, pouvant ainsi profiter de l'accumulateur 12 V de la voiture de location.

Les lieux d'observations ont été définis à l'aide des cartes topographiques mentionnées dans la bibliographie (Instituto Geográfico e Cadastral, 1971, 1979), mais ils peuvent être localisés également sur des cartes touristiques, p. ex. Madeira, publiée par le «Secretaria Regional do Turismo e Cultura» à Funchal. Pour permettre un repérage facile, les coordonnées géographiques (réseau international) sont ajoutées. Les numéros correspondent à ceux utilisés dans la carte fig. 1.

ILHA DA MADEIRA
ILHA DO PORTO SANTO
Porto Santo
16°20'
33'
00'
Porto Moniz
Santana
Calheta
Ponta do Sol
Ribeira Brava
Câmara de Lobos
FUNCHAL
Santa Cruz
Machico
32'
40'
17°00'
Ilhéu Chão
Deserta Grande
Ilhas Desertas
Bugio
32'
30'
16°30'
Légende:
Localites principales
Capitale
Altitudes
0-1000M
1000-1500M
> 1500M
Lieux d'observation
Echelle
0
5
10KM

Fig. 1.

Liste des lieux d'observations (par ordre alphabétique) :

No.	Localité	Description de la situation du lieu d'observation	Coordonnées géographiques
1	Achada do Cedro Gordo	2 km NE Ribeiro Frío	32°44'N/16°52'W
2	Agua de Pena	emb. río do Seixo	32°42'N/16°45'W
3	Cabo Girao	Fontanhas do Mar	32°39'N/17°00'W
4	Camara dos Lobos	Covâo	32°40'N/16°58'W
5	Cruzinhas	Fajâ do Cedro Gordo	32°45'N/16°52'W
6	Curral das Freiras	Curral de Baixo (SE)	32°42'N/16°58'W
7	Curral das Freiras	Achada (N)	32°43'N/16°58'W
8	Faja de Nogueira	3 km NE, R. Ametade	32°44'N/16°53'W
9	Funchal	Santo Martinho	32°38'N/16°56'W
10	Jardim da Serra	2 km N, Fte. Capelinha	32°42'N/16°59'W
11	Machico	4 km NW, -> Sto da Serra	32°43'N/16°47'W
12	Madalena do Mar	-> Canhas, Canto de Passo	32°41'N/16°52'W
13	Monte	Choupana	32°40'N/16°53'W
14	Paúl da Serra	-> Fanal	32°48'N/17°08'W
15	Pico dos Barcelos	W Funchal	32°39'N/16°56'W
16	Poiso	-> Pico Arieiro	32°42'N/16°53'W
17	Porto do Moniz	Po. da Assumada	32°51'N/17°10'W
18	Queimadas	Rib. do Seisal	32°46'N/16°53'W
19	Quinta Grande	Câmara do Bispo	32°39'N/17°00'W
20	Ribeira da Janela	loc.	32°50'N/17°09'W
21	Santa Cruz	Rib. de Sta. Cruz	32°40'N/16°47'W

Liste des espèces observées :

Dans ce cadre, il n'est pas possible de mentionner les nombreuses synonymies. Les noms de genres utilisés pour certaines espèces endémiques sont également à considérer comme provisoires. Ces problèmes feront l'objet d'une analyse taxonomique et systématique des Lépidoptères de Madère qui sera publiée ultérieurement.

GEOMETRIDAE

1. **Xenochlorodes nubigena** WOLLASTON, 1858

In coll. Meyer/Hellers : 16.5.1989, Curral das Freiras (4) ; 15.5.1989, Fajâ de Nogueira (1) ; 18.5.1989, Paúl da Serra (7).

2. **Cyclophora maderensis** BAKER, 1891

In coll. Meyer/Hellers : 13.5.1989, Câmara de Lobos (2) ; 16.5.1989, Curral das Freiras (4) ; 20.5.1989, Machico (1) ; 18.5.1989, Paúl da Serra (8).

3. **Scopula irrorata** Baker, 1891

In coll. Meyer/Hellers : 22.5.1989, Cabo Girâo (10) ; 13.5.1989, Câmara de Lobos (2) ; 16.5.1989, Curral das Freiras (11) ; 14.5.1989, Funchal (1) ; 20.5.1989, Machico (2) ; 18.5.1989, Paúl da Serra (1).

4. **Idaea maderae** Baker, 1891
(= *unostrigata* Baker, 1891 ; = *zargi* Baker, 1891)

In coll. Meyer/Hellers : 20.5.1989, Machico (2 ♂, 1 ♀) ; 15.5.1989, Fajâ de Nogueira (2 ♂).

5. **Idaea atlantica** Stainton, 1859 (nec *atlantica* Walker)
(= ? *illuminata* Prout, 1939)

Le statut du nom de *atlantica* Stt. n'est pas clair, puisque les types (♂ et ♀), conservés au British Museum, ressemblent beaucoup à *longaria* H. Sch. (cf. Prout, 1912 ff., 1939). En outre, la collection des Sterrhinae de Madère au British Museum constitue un mélange peu convainquant. Aussi mentionnons-nous sous le nom de *I. atlantica* seulement les individus identiques aux types :

In coll. Meyer/Hellers : 22.5.1989, Cabo Girâo (1 ♂, 1 ♀).

Remarque : Les individus suivants ont pratiquement le même dessin que *I. atlantica*, mais le fond des ailes est de couleur rouge-brun. L'identification définitive ne sera possible qu'après l'examen des génitalias.

In coll. Meyer/Hellers : 18.5.1989, Porto do Moniz (3 ♂).

6. **Xanthorhoe centrostrigaria** Wollaston, 1858

In coll. Meyer/Hellers : 15.5.1989, Achada do Cedro Gordo (1) ; 22.5.1989, Cabo Girâo (4) ; 13.5.1989, Câmara de Lobos (11) ; 13.5.1989, Curral das Freiras (1) ; 16.5.1989, Curral das Freiras (9) ; 15.5.1989, Fajâ de Nogueira (5) ; 20.5.1989, Machico (1) ; 18.5.1989, Paúl da Serra (8) ; 13.5.1989, Pico dos Barcelos (3) ; 13.5.1989, Poiso (1) ; 19.5.1989, Quinta Grande (1).

7. **Xanthorhoe rupicola** Wollaston, 1858

In coll. Meyer/Hellers : 22.5.1989, Cabo Girâo (2) ; 13.5.1989, Câmara de Lobos (4) ; 16.5.1989, Curral das Freiras (10) ; 15.5.1989, Fajâ de Nogueira (8) ; 20.5.1989, Machico (3) ; 18.5.1989, Paúl da Serra (26) ; 18.5.1989, Porto do Moniz (1).

8. **Gymnoscelis lundbladi** Prout, 1939

In coll. Meyer/Hellers : 22.5.1989, Cabo Girâo (18) ; 13.5.1989, Câmara de Lobos (6) ; 15.5.1989, Fajâ de Nogueira (1) ; 20.5.1989, Machico (2) ; 18.5.1989, Paúl da Serra (4).

9. **Gymnoscelis rufifasciata** ssp. **insulariata** Stainton, 1859

In coll. Meyer/Hellers : 22.5.1989, Cabo Girâo (1) ; 13.5.1989, Câmara de Lobos (3) ; 16.5.1989, Curral das Freiras (1) ; 15.5.1989, Fajâ de Nogueira (13) ; 20.5.1989, Machico (1) ; 18.5.1989, Paúl da Serra (10).

10. **Eupithecia latipennata** Prout, 1914

In coll. Meyer/Hellers : 13.5.1989, Câmara de Lobos (1) ; 16.5.1989, Curral das Freiras (6) ; 15.5.1989, Fajâ de Nogueira (8) ; 20.5.1989, Machico (1).

11. **Eupithecia atlanticata** Pinker, 1969

La description sommaire et la photo trop petite chez Pinker (1969) (localité citée dans la légende : Furnas, Açores (?)) ne permettent pas de classer définitivement les exemplaires capturés sans analyse des génitalias.
In coll. Meyer/Hellers : 22.5.1989, Cabo Girâo (3).

12. **Hemerophila maderae** Baker, 1891

In coll. Meyer/Hellers : 15.5.1989, Fajâ de Nogueira (1) ; 18.5.1989, Paúl da Serra (3).

13. **Boarmia fortunata** ssp. **wollastoni** Baker, 1891

In coll. Meyer/Hellers : 13.5.1989, Câmara de Lobos (1) ; 16.5.1989, Curral das Freiras (8) ; 15.5.1989, Fajâ de Nogueira (24) ; 20.5.1989, Machico (3) ; 18.5.1989, Paúl da Serra (4).

14. **Rhodometra sacraria** Linnaeus, 1767

In coll. Meyer/Hellers : 18.5.1989, Ribeira da Janela (1).

Sphingidae

15. **Agrius convolvuli** Linnaeus, 1758

In coll. Meyer/Hellers : 17.5.1989, Madalena do Mar (1).

16. **Macroglossum stellatarum** Linnaeus, 1758

In coll. Meyer/Hellers : 19.5.1989, Quinta Grande (1).

Noctuidae

17. **Agrotis segetum** Denis & Schiffermüller, 1775

In coll. Meyer/Hellers : 13.5.1989, Câmara de Lobos (1) ; 15.5.1989, Fajâ de Nogueira (2) ; 20.5.1989, Machico (5) ; 18.5.1989, Paúl da Serra (1) ; 13.5.1989, Poiso (1).

18. **Ochropleura leucogaster** Freyer, 1831

Espèce nouvelle pour la faune de Madère !
In coll. Meyer/Hellers : 16.5.1989, Curral das Freiras (1) ; 15.5.1989, Fajâ de Nogueira (1).

19. **Xestia c-nigrum** Linnaeus, 1758

Espèce nouvelle pour la faune de Madère !
In coll. Meyer/Hellers : 13.5.1989, Câmara de Lobos (2).

20. **Noctua pronuba** Linnaeus, 1758

In coll. Meyer/Hellers : 22.5.1989, Cabo Girâo (13) ; 13.5.1989, Câmara de Lobos (3) ; 16.5.1989, Curral das Freiras (2) ; 20.5.1989, Machico (4).

21. **Peridroma saucia** Huebner, 1808

In coll. Meyer/Hellers : 15.5.1989, Fajâ de Nogueira (3) ; 16.5.1989, Curral das Freiras (1) ; 20.5.1989, Machico (1).

22. **Mythimna unipuncta** Haworth, 1809

In coll. Meyer/Hellers : 22.5.1989, Cabo Girâo (1) ; 13.5.1989, Câmara de Lobos (1) ; 15.5.1989, Fajâ de Nogueira (4) ; 20.5.1989, Machico (3) ; 18.5.1989, Paúl da Serra (1).

23. **Euplexia dubiosa** Baker, 1891

In coll. Meyer/Hellers : 16.5.1989, Curral das Freiras (1) ; 15.5.1989, Fajâ de Nogueira (15) ; 20.5.1989, Machico (1) ; 18.5.1989, Paúl da Serra (27).

24. **Phlogophora wollastoni** Baker, 1891

In coll. Meyer/Hellers : 22.5.1989, Cabo Girâo (1) ; 13.5.1989, Câmara de Lobos (4) ; 16.5.1989, Curral das Freiras (8) ; 15.5.1989, Fajâ de Nogueira (15) ; 18.5.1989, Paúl da Serra (9).

25. **Blepharita albostigmata** Baker, 1891

In coll. Meyer/Hellers : 18.5.1989, Paúl da Serra (2).

26. **Caradrina clavipalpis** ssp. **pinkeri** Kobes, 1975

In coll. Meyer/Hellers : 22.5.1989, Cabo Girâo (9) ; 13.5.1989, Câmara de Lobos (5) ; 16.5.1989, Curral das Freiras (14) ; 15.5.1989, Fajâ de Nogueira (4) ; 20.5.1989, Machico (2) ; 18.5.1989, Paúl da Serra (3).

27. **Galgula partita** Guenée, 1852

In coll. Meyer/Hellers : 22.5.1989, Cabo Girâo (1) ; 15.5.1989, Cruzinhas (1) ; 15.5.1989, 13.5.1989, Curral das Freiras (2) ; 15.5.1989, Fajâ de Nogueira (1) ; 17.5.1989, Madalena do Mar (4) ; 14.5.1989, Monte (1) ;

18.5.1989, Paúl da Serra (1) ; 13.5.1989, Pico dos Barcelos (1) ; 19.5.1989, Quinta Grande (1).

28. **Ctenoplusia limbirena** Guenée, 1852

In coll. Meyer/Hellers : 16.5.1989, Curral das Freiras (1) ; 15.5.1989, Fajâ de Nogueira (1).

29. **Cornutiplusia circumflexa** Linnaeus, 1767

In coll. Meyer/Hellers : 15.5.1989, Fajâ de Nogueira (2) ; 13.5.1989, Pico dos Barcelos (1) ; 19.5.1989, Quinta Grande (1).

30. **Autographa gamma** Linnaeus, 1758

In coll. Meyer/Hellers : 19.5.1989, Quinta Grande (1).

31. **Chrysodeixes chalcites** Esper, 1789

In coll. Meyer/Hellers : 20.5.1989, Agua de Pena (1) ; 20.5.1989, Machico (13).

32. **Hypena obsitalis** Huebner, 1813

In coll. Meyer/Hellers : 13.5.1989, Câmara de Lobos (1) ; 18.5.1989, Paúl da Serra (2).

33. **Schrankia costaestrigalis** Stephens, 1834

In coll. Meyer/Hellers : 15.5.1989, Fajâ de Nogueira (1).

Pieridae

34. **Pieris rapae** Linnaeus, 1758

Ce Piéride a été signalé de Madère en début du xxe siècle, mais avec un certain doute (cf. Rebel, 1917, cit. Oehmig, 1977). Depuis 1971, les lépidoptéristes qui ont visité Madère la trouvent communément sur pratiquement tout le territoire (Higgins, 1977 ; Oehmig, 1977). Il s'agit sans doute d'une introduction involontaire par l'homme et l'espèce se concentre autour des habitations (plantations de choux). Il n'y a aucune différenciation par rapport aux populations continentales adjacentes.

In coll. Meyer/Hellers : 15.5.1989, Achada do Cedro Gordo (3) ; 20.5.1989, Agua de Pena (2) ; 21.5.1989, Cabo Girâo (2) ; 15.5.1989, Cruzinhas (1) ; 14.5.1989, Monte (1) ; 13.5.1989, Pico dos Barcelos (5) ; 19.5.1989, Quinta Grande (1) ; 20.5.1989, Santa Cruz (1).
Obs : 21.5.1989, Cabo Girâo ; 22.5.1989, Curral das Freiras ; 17.5.1989, Madalena do Mar ; 19.5.1989, Quinta Grande ; 20.5.1989, Santa Cruz.

35. **Colias crocea** Geoffroy, 1785

In coll. Meyer/Hellers : 15.5.1989, Achada do Cedro Gordo (1) ; 16.5.1989, Jardim da Serra (15) ; 13.5.1989, Pico dos Barcelos (4) ; 18.5.1989, Porto do Moniz (1).
Obs : 20.5.1989, Agua de Pena ; 21.5.1989, Cabo Girâo ; 22.5.1989, Curral das Freiras ; 17.5.1989, Madalena do Mar ; 13.5.1989, Poiso ; 19.5.1989, Quinta Grande ; 20.5.1989, Santa Cruz.

Lycaenidae

36. **Lycaena phlaeas** ssp. **phlaeoides** Staudinger & Rebel, 1901

In coll. Meyer/Hellers : 15.5.1989, Achada do Cedro Gordo (1) ; 16.5.1989, Cabo Girâo (4) ; 15.5.1989, Cruzinhas (1) ; 16.5.1989, Curral das Freiras (2) ; 21.5.1989, Jardim da Serra (10) ; 13.5.1989, Poiso (3) ; 19.5.1989, Quinta Grande (3).
Obs : 22.5.1989, Curral das Freiras.

37. **Lampides boeticus** Linnaeus, 1767

In coll. Meyer/Hellers : 15.5.1989, Achada do Cedro Gordo (2) ; 15.5.1989, Cruzinhas (2) ; Curral das Freiras (2) ; 16.5.1989, Jardim da Serra (5) ; 17.5.1989, Madalena do Mar (1) ; 13.5.1989, Pico dos Barcelos (9) ; 18.5.1989, Porto do Moniz (2) ; 18.5.1989, Ribeira da Janela (2).
Obs : 20.5.1989, Agua de Pena ; 21.5.1989, Cabo Girâo ; 22.5.1989, 19.5.1989, Quinta Grande ; 20.5.1989, Santa Cruz.

Danaidae

38. **Danaus plexippus** Linnaeus, 1758

In coll. Meyer/Hellers : 20.5.1989, Agua de Pena (2).
Obs : 16.5.1989, Câmara de Lobos (1) ; 16.5.1989, Funchal (1) ; 19.5.1989 ibid. (5).

Satyridae

39. **Pararge xiphia** Fabricius, 1775

In coll. Meyer/Hellers : 15.5.1989, Achada do Cedro Gordo (14) ; 13.5.1989 (4) + 22.5.1989 (2), Curral das Freiras ; 15.5.1989, Cruzinhas (2) ; 16.5.1989, Jardim da Serra (2) ; 13.5.1989, Pico dos Barcelos (1) ; 18.5.1989, Porto do Moniz (1) ; 18.5.1989, Ribeira da Janela (7).
Obs : 20.5.1989, Agua de Pena ; 21.5.1989, Cabo Girâo ; 22.5.1989, Curral das Freiras ; 14.5.1989, Monte.

40. **Pararge aegeria** ssp. **aegeria** Linnaeus, 1758

In coll. Meyer/Hellers : 15.5.1989, Achada do Cedro Gordo (2) ; 13.5.1989, Curral das Freiras (6) ; 16.5.1989, Jardim da Serra (1) ; 14.5.1989, Monte (4) ; 13.5.1989, Pico dos Barcelos (9) ; 18.5.1989, Ribeira da Janela (2).
Obs : 20.5.1989, Agua de Pena ; 21.5.1989, Cabo Girâo ; 19.5.1989, Quinta Grande ; 20.5.1989, Santa Cruz.

Cette espèce n'a été signalée que depuis les années 60/70 (Higgins, 1977 ; Oehmig, 1977, 1982). Une description détaillée des premières captures à Madère se trouve chez Oehmig (1982). Owen et al. (1986), ignorant apparemment les publications de Oehmig, essaient de retracer la colonisation de cette espèce sur l'île de Madère. Ils ont trouvé *P. aegeria* souvent sympatrique avec l'endémique *P. xiphia*, surtout dans la partie orientale de Madère.

Owen *et al.* (1986) pensent que *P. xiphia* serait dérivée d'une forme ancestrale de *P. aegeria* qui aurait colonisé jadis l'île de Madère et qui, par la suite, se serait différenciée jusqu'à l'espèce. Cela me paraît erroné, puisque les deux espèces *P. xiphia* et *P. xiphioides* présentent des caractères nettement plus primitifs que *P. aegeria*. Il est beaucoup plus probable que les deux taxons endémiques des îles atlantiques constituent des reliques anciennes relativement peu évoluées et que *P. aegeria*, l'ex-vicariante continentale, soit l'élément plus jeune qui vient de s'implanter récemment (la date exacte étant pure spéculation !), et ceci sûrement par l'intermédiaire de l'homme, ne fût-ce que par les changements des écosystèmes naturels favorisant ainsi une espèce profitant de biotopes anthropogènes (fait mentionné d'ailleurs également par Owen et al. (1986)). On a une situation analogue en Sardaigne où *Papilio machaon* s'est implanté en temps historique à côté de l'endémique relictaire *P. hospiton*.

Owen et al. (1986) concluent à propos de la colonisation de Madère par *Pararge* sp. : «Assuming this happened in prehistoric times there is every reason to suppose it could happen again in modern times». Il est cependant bien clair qu'une spéciation par isolement est peu probable si le même flux génétique continue à fonctionner. Ce qui est plus probable dans ce cas, c'est qu'un changement récent du milieu (agriculture !) soit intervenu sur l'île de Madère, favorisant ainsi l'implantation de *P. aegeria* dans une niche écologique complémentaire à celle de *P. xiphia*. Avant cette situation, *P. xiphia* était capable de refouler d'éventuelles tentatives de colonisation de *P. aegeria* dans la même niche écologique et les observations récentes des auteurs ne confirment aucune dominance de *P. aegeria* sur *P. xiphia*. Il paraît

beaucoup plus probable que soit juste la remarque de Owen et al. (1986) : «it is possible that the disappearance of *P. xiphia* from ‚disturbed' areas is more a result of habitat change than of competition with *P. aegeria*».

Nymphalidae

41. **Vanessa atalanta** Linnaeus, 1758

In coll. Meyer/Hellers : 15.5.1989, Cruzinhas (1) ; 15.5.1989, Queimadas (1).

42. **Vanessa indica** ssp. **occidentalis** Felder, 1862

In coll. Meyer/Hellers : 15.5.1989, Cruzinhas (1) ; 17.5.1989, Madalena do Mar (1) ; 18.5.1989, Ribeira da Janela (1).
Obs : 13. + 22.5.1989, Curral das Freiras ; 13.5.1989, Pico dos Barcelos.

43. **Vanessa cardui** Linnaeus, 1758

In coll. Meyer/Hellers : 18.5.1989, Paúl da Serra (1).
Obs : 13.5.1989, Pico dos Barcelos.

44. **Issoria lathonia** Linnaeus, 1758

In coll. Meyer/Hellers : 17.5.1989, Madalena do Mar (1).

Addendum

Observations lors d'une excursion le 24.5.1989 à Porto Santo :

Pieris rapae Linnaeus, 1758
Colias crocea Geoffroy, 1785
Vanessa atalanta Linnaeus, 1758
Vanessa indica ssp. **occidentalis** Felder, 1862

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La protection des populations de *P. apollo* L. dans le sud de la France : étude génétique préliminaire (Lepidoptera, Papilionidae)

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Résumé

Quinze populations de *Parnassius apollo* L. du sud de la France ont été étudiées par électrophorèse et vingt par biométrie des éléments de la patterne alaire. Les analyses multivariées effectuées sur ces données révèlent une structuration géographique bien nette. Si les analyses électrophorétiques n'individualisent que deux grands groupes — un septentrional et un méridional —, les critères biométriques séparent de plus un troisième sous-ensemble constitué par les échantillons du Vaucluse et de l'Aigoual. Les observations de terrain ont montré que les populationq alpines n'étaient pas en danger mais qu'il n'en était pas de même pour les colonies du Massif central dont les localités sont fortement dégradées à la fois par le développement et la déprise et, de plus, dont la diversité génétique est apparue appauvrie.

Introduction

Un travail précédent (Napolitano, 1989a et b) a montré que les populations de *Parnassius mnemosyne* présentaient dans le Sud-Est de la France, une structure génétique bien définie, mise en évidence avec beaucoup de netteté par l'électrophorèse et, moins précisément, par la biométrie de la patterne alaire. Ces résultats montrent que le Lépidoptère concerné possède une histoire ancienne et complexe dans les Alpes du Sud. En revanche les populations pyrénéennes et centraliennes, étudiées il est vrai sur des échantillons limités, présentent une faible différenciation ; ce qu'il est possible d'expliquer par une colonisation récente. Par ailleurs, on note un affaiblissement de la variation génotypique et phénotypique étroitement proportionnel au degré d'isolement des populations.

En Europe comme en France, les *Parnassius* ont attiré l'attention des protectionnistes. *Parnassius apollo* est le premier insecte qui ait été déclaré protégé dans le monde (en Allemagne, 1936). Si certaines de leurs colonies ont fait l'objet d'une étude génétique (Racheli et al.,

1983), aucun travail, à notre connaissance, ne s'est attaché à mesurer la divergence génétique entre ces populations. Une telle démarche est pourtant nécessaire afin de définir les unités démiques succeptibles de bénéficier de mesures de protection (Lacy, 1988).

Nous insisterons ici sur les problèmes posés par *P. apollo*, l'espèce la plus connue, et nous concentrerons l'attention sur les aspects génétiques et écologiques de sa protection. En particulier, nous avons fait le point de l'état de quelques populations de *P. apollo* dans le sud de la France et commencé d'analyser son polymorphisme enzymatique. Les méthodes utilisées s'inspirent de celles mises au point avec *P. mnemosyne*. Il est déjà possible de répondre partiellement aux questions :

— Où sont situées les populations les plus vulnérables ?

— Quelle est la gravité de la situation ?

— Quelle est l'originalité génétique des populations menacées ?

— Quelles sont les populations les plus importantes à préserver ?

— Quelles actions sont envisageables ?

Matériels et méthodes

En France, *P. apollo* est résident dans les Vosges, le Jura, le Massif Central (Auvergne et Cantal, Vivarais, Cévennes et Forez, Causses), les Alpes et les Pyrénées (Capdeville, 1978). Il est très abondant dans ces deux derniers massifs. Jusqu'à une époque récente, on ne considérait comme éteintes, en France, que quelques populations très marginales : extrême nord du Jura, Forez. Historiquement, on a pu supposer l'extinction de l'espèce au Mont Pilat, voire au Mont d'Or, près de Lyon, où sa présence a été inférée indirectement de témoignages assez solides (Rougeot, 1964). Dans les temps récents, un déclin très net de l'espèce a été noté dans des régions où elle semblait bien implantée : les Vosges, le Massif Central. Ce phénomène semble s'accélérer, comme en témoignent les observations récentes de Bachelard (1988) et nos propres investigations lors des étés 1989 et 1990.

Par ailleurs, l'espèce est capable de former des populations abyssales (350 m dans le Vaucluse et le Jura, 500 m dans les Causses), voire de coloniser d'une manière éphémère des localités marginales (plateau de Millevaches : Borde, comm. pers.). Son observation dans des régions éloignées de son aire de distribution normale (Bourgogne, Grande Bretagne : Constant, 1866, Howarth 1973) témoigne de ses capacités de déplacement.

Analyse électrophorétique : Les papillons (N = 151) ont été collectés dans les quinze localités indiquées sur la carte 1. Le protocole expérimental classique d'électrophorèse verticale a été décrit dans Napolitano, Descimon et Geiger (1988). Les locus étudiés sont ceux qui se sont révélés polymorphes chez *P. mnemosyne*. D'autre part, deux systèmes enzymatiques supplémentaires ont été testés (HBDH et AcP).

L'analyse des données a été réalisée grâce aux logiciels BIOSYS-1 de Swofford et Selander (1981) et STAT-ITCF. L'étude de la différenciation génétique entre les populations a reposé d'une part, sur l'emploi des statistiques F — F_{IS}, F_{ST} et F_{IT} — (Wright, 1978) et, d'autre part, sur la mise en œuvre d'une série d'analyses multivariées — analyses et composantes principales (ACP), analyse factorielle des correspondances (AFC) et analyse factorielle discriminante (AFD).

La significativité des valeurs de F_{IS} a été obtenue à partir de la relation :

$$X^2 = N(F_{IS})^2 \text{ (Li et Horvitz, 1953)}$$

avec (S-1)(k-1) degrés de liberté (d.l.). N est le nombre total d'individus échantillonnés ; k est le nombre d'allèles identifié à un locus donné et s est le nombre de populations étudiées.

Les valeurs de F_{ST} calculées pour chacun des locus polymorphes ont été comparées à l'hypothèse nulle ($F_{ST} = 0$) qui indique une absence de différenciation génétique entre les colonies par un test du X^2 (Workman et Niswander, 1970) où

$$X^2 = 2NF_{ST}(k\text{-}1) \text{ et d.l.} = (k\text{-}1)(s\text{-}1)$$

Analyse biométrique : L'analyse biométrique a reposé sur la mesure des caractères de la patterne alaire. Dans une étape préliminaire, vingt six d'entre eux ont été choisis. Une ACP portant sur un échantillon de quarante individus de collection appartenant à quatre régions biogéographiques bien tranchées (Massif Central, Pyrénées, Savoie et Alpes Maritimes) a été entreprise afin de réduire le nombre ultérieur de mesures à effectuer. Ce type de protocole expérimental nous a permis ainsi de définir une série de douze caractères, peu corrélés entre eux, bons descripteurs de la variabilité phénotypique de l'espèce. Par la suite, nous avons étendu nos mesures à d'autres individus de collection (Jura) ainsi qu'à la plupart des papillons soumis à l'électrophorèse.

La variabilité biométrique de l'ensemble de nos échantillons a été évaluée par le calcul des coefficients d'aplatissement par caractère. De plus, nous avons réalisé une ACP et une AFD afin de déceler d'éventuels gradients phénotypiques entre nos diverses populations.

Carte 1. Populations de *Parnassius apollo* étudiées par électrophorèse et biométrie (gros cercles noirs) et par biométrie seule (petits cercles noirs). 1 : Jura central ; 2 : Haute Savoie ; 3 : le Bez (Briançonnais) ; 4 : Lachau près Cervières (id.) ; 5 : Haute Tinée (lacs du Lausfer et de Vens, Saint Dalmas le Selvage, Peyre Blanque regroupés) ; 6 : Haute Vésubie (Gordolasque, Madone de Fenestre, Boréon et col de Salèze regroupés) ; 7 : Pyrénées-Orientales (environs de Montlouis) ; 8 : Hautes-Pyrénées (Cauterets et Gèdre) ; 9 : plateau de Vaucluse ; 10 : Grand Luberon ; 11 : Aigoual ; 12 : Causse du Larzac, Méjean et de Sauveterre.
La Montagne de Lure, non figurée sur la carte, est située au N.-E. de 9.

Résultats

1) *Observations de terrain* : Dans les différentes localités visitées, la densité des peuplements était très variable. Dans les Alpes, d'une manière absolument générale, les individus sont à la fois omniprésents et abondants. Dans les plateaux du Vaucluse, on observe des colonies isolées, mais répandues partout où existent des biotopes favorables, même très bas (350 m). Dans le Massif central, en revanche, la seule colonie que nous avons pu observer se trouve à l'Aigoual et est extrêmement restreinte. Nous avons visité les localités très classiques des Causses où l'espèce était encore abondante avant 1989 ; mais nous n'y avons observé aucun individu. Il est plus raisonnable d'admettre que les conditions météorologiques exceptionnelles ont provoqué une avance extrême de la phénologie et que les populations nous ont échappé. En revanche, dans l'axe Cévennes-Mézenc, un déclin très net a été observé depuis plusieurs années. Il est essentiellement dû à l'envahissement par les genêts de la plupart des localités ; parfois aussi par le «re»boisement volontaire de certains sites. De même, nous avons visité en juillet de nombreuses localités citées dans la littérature. S'il est vraisemblable que l'avance aberrante de la saison entomologique a joué un rôle dans cet échec, il est certain qu'un déclin important peut aussi être à l'origine de l'absence d'observations, comme en témoignent les travaux de Bachelard (1988). D'autre part, certaines localités «classiques» ont été purement et simplement détruites par des implantations touristiques, en particulier au Mont Dore.

2) *Analyse électrophorétique* : Le Tableau 1 présente les fréquences alléliques calculées pour l'ensemble de nos échantillons. Seuls cinq locus se sont révélés polymorphes sur les onze testés (GOT, PGI, PGM, HK et MDH).

L'hétérozygotie moyenne observée varie de 0,07 au Lac de Vens à 0,23 dans la colonie du Bez (Tableau 2). La colonie du Mont Aigoual, seule population échantillonnée dans le Massif Central, présente une faible diversité génétique (0,08). Les trois colonies du Briançonnais (Cervières, Le Bez et Montgenèvre), au contraire, sont très polymorphes.

Le Tableau 3 présente l'ensemble des valeurs des statistiques F (F_{IS}, F_{ST} et F_{IT}) calculées pour chacun des locus polymorphes. La moyenne des F_{IT}, tous locus confondus, atteint 0,49 ; ce qui suggère que les quinze populations considérées dans leur ensemble ne peuvent être assimilées à une unité panmictique. Les valeurs des F_{IT} pour chacun des locus sont toutes positives. Elles varient de 0,345 pour HK à 0,618 pour GOT. Un tel résultat montre que les cinq systèmes enzymatiques

Tableau 1. Fréquences alléliques moyennes calculées aux cinq locus polymorphes dans les quinze populations échantillonnées.

	GOT			PGI			PGM				HK		MDH	
	95	100	107	95	100	115	95	100	105	117	100	110	100	110
Madone de Fenestre	0,33	0,67	0,0	0,0	0,33	0,67	0,0	1,0	0,0	0,0	1,0	0,0	1,0	0,0
Le Bez	0,03	0,84	0,13	0,0	0,52	0,48	0,0	0,98	0,0	0,02	0,53	0,47	1,0	0,0
Aigoual	0,0	0,85	0,15	0,0	1,0	0,0	0,0	0,95	0,0	0,05	1,0	0,0	1,0	0,0
Sénanque	0,0	1,0	0,0	0,0	1,0	0,0	0,0	1,0	0,0	0,0	1,0	0,0	1,0	0,0
Lac de Vens	0,0	1,0	0,0	0,0	0,94	0,06	0,0	1,0	0,0	0,0	1,89	0,11	1,0	0,0
Lubéron	0,0	0,86	0,14	0,0	0,79	0,21	0,0	1,0	0,0	0,0	1,0	0,0	1,0	0,0
Montgenèvre	0,0	1,0	0,0	0,0	1,0	0,0	0,0	1,0	0,0	0,0	0,5	0,5	1,0	0,0
Le Boréon	0,0	1,0	0,0	0,0	0,54	0,46	0,0	0,58	0,0	0,42	0,67	0,33	1,0	0,0
Gordolasque	0,0	1,0	0,0	0,0	1,0	0,0	0,0	0,75	0,25	0,0	0,5	0,5	1,0	0,0
Lausfer	0,12	0,88	0,0	0,06	0,77	0,17	0,0	0,82	0,18	0,0	0,56	0,44	0,97	0,03
Peyre Blanque	0,21	0,79	0,0	0,0	0,89	0,11	0,0	0,54	0,46	0,0	0,57	0,43	1,0	0,0
Saint Dalmas	0,0	1,0	0,0	0,0	0,83	0,17	0,42	0,5	0,0	0,08	0,96	0,04	1,0	0,0
Lure	0,0	1,0	0,0	0,0	0,0	1,0	0,0	1,0	0,0	0,0	1,0	0,0	1,0	0,0
Salèze	0,0	1,0	0,0	0,0	0,0	1,0	0,0	1,0	0,0	0,0	1,0	0,0	1,0	0,0
Cervières	0,0	0,94	0,06	0,0	0,69	0,31	0,0	0,94	0,0	0,06	0,75	0,25	0,72	0,28

Tableau 2. Hétérozygotie par locus, hétérozygotie moyenne attendue selon l'hypothèse panmictique et hétérozygotie moyenne observées pour chacune des quinze populations échantillonnées.

Populations	GOT	PGI	PGM	HK	MDH	H.att.	H.obs.
Madone de Fenestre	0,44	0,44	0,00	0,00	0,00	0,18	0,13
Le Bez	0,28	0,50	0,03	0,49	0,00	0,26	0,23
Aigoual	0,26	0,00	0,10	0,00	0,00	0,07	0,08
Sénanque	0,00	0,00	0,00	0,00	1,00	0,00	0,00
Lac de Vens	0,00	0,11	0,00	0,20	0,00	0,06	0,07
Lubéron	0,25	0,34	0,00	0,00	0,00	0,12	0,14
Montgenèvre	0,00	0,00	0,00	0,50	0,00	0,10	0,20
Le Boréon	0,00	0,49	0,48	0,44	0,00	0,28	0,15
Gordolasque	0,00	0,00	0,38	0,50	0,00	0,17	0,10
Lausfer	0,21	0,38	0,29	0,49	0,06	0,29	0,17
Peyre Blanque	0,34	0,19	0,49	0,49	0,00	0,30	0,20
Saint Dalmas	0,00	0,27	0,57	0,08	0,00	0,18	0,12
Lure	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Salèze	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Cervières	0,11	0,42	0,11	0,38	0,40	0,28	0,22

Tableau 3. Tableau récapitulatif des valeurs statistiques F calculées, pour chacun des locus, entre l'ensemble des populations échantillonnées.

Locus	F(is)	F(it)	F(st)
GOT	0,549	0,618	0,153
PGI	0,044	0,535	0,513
PGM	0,358	0,553	0,304
HK	0,105	0,345	0,268
MDH	0,144	0,348	0,238
Moyenne	0,216	0,490	0,350

présentent un excès d'homozygotes à cette échelle d'observation. Dans ces conditions, l'aire échantillonnée est composée de populations génétiquement différenciées. Pour mieux apprécier ce degré de variation géographique, nous avons effectué une analyse hiérarchisée de la variance génétique à deux niveaux de structuration : entre les localités

échantillonnées et les régions d'une part (Hautes Alpes, Massif Central et plateaux du Vaucluse, Alpes Maritimes) ; entre ces régions et l'ensemble de l'aire échantillonnée, d'autre part. Les résultats sont indiqués dans le tableau 4. Ils mettent en évidence la part importante de la variation intra-régionale par rapport à la variation inter-régionale des populations.

Tableau 4. Estimation de la différenciation génétique *intra locus* selon trois niveaux de hiérarchie des statistiques F.

	GOT	PGI	PGM	HK	MDH
Localités/régions	0,108	0,543	0,252	0,099	0,200
Localités/total	0,095	0,487	0,255	0,175	0,217
Régions/total	0,000	0,000	0,005	0,084	0,022

L'analyse factorielle des correspondances (AFC) présentée à la figure 1 met en évidence deux subdivisions géographiques bien visibles. Les individus échantillonnés dans les Alpes Maritimes, toutes populations confondues, forment un groupe nettement individualisé le long du premier facteur alors que les papillons collectés dans les Hautes Alpes sont bien discriminés par le second axe. Sur le plan 1-2 de l'analyse sont représentés également certains variants enzymatiques. Ainsi les allèles PGM-105 et GOT-93 sont caractéristiques des échantillons des Alpes Maritimes.

Les populations du Vaucluse (Sénanque et Lubéron) ou du Massif Central (Mont Aigoual) ne semblent pas posséder d'allèles particuliers. Leurs individus ne peuvent être distingués de ceux des Hautes Alpes dont ils semblent être une version génétique appauvrie. En revanche ils ne peuvent être confondus avec les échantillons des Alpes Maritimes : en effet, leurs deux enveloppes sont disjointes.

L'analyse en composantes principales (ACP) permet, elle, de préciser les relations entre les populations (Figure 2). Les colonies des Alpes Maritimes (Lausfer, Peyre Blanque, Saint Dalmas), bien représentées le long du second facteur, sont caractérisées par l'influence des génotypes PGM 100-105 et GOT 93-100 (Figure 3). Un tel résultat était prévisible puisque les allèles PGM-105 et GOT-93 contribuaient déjà à une part importante de l'inertie expliquée par l'axe principal de l'AFC.

Les populations situées près de l'origine des axes ne participent guère à la définition des plans de projections. Il n'est donc pas étonnant d'y retrouver là les colonies du Vaucluse et de l'Aigoual qui, nous

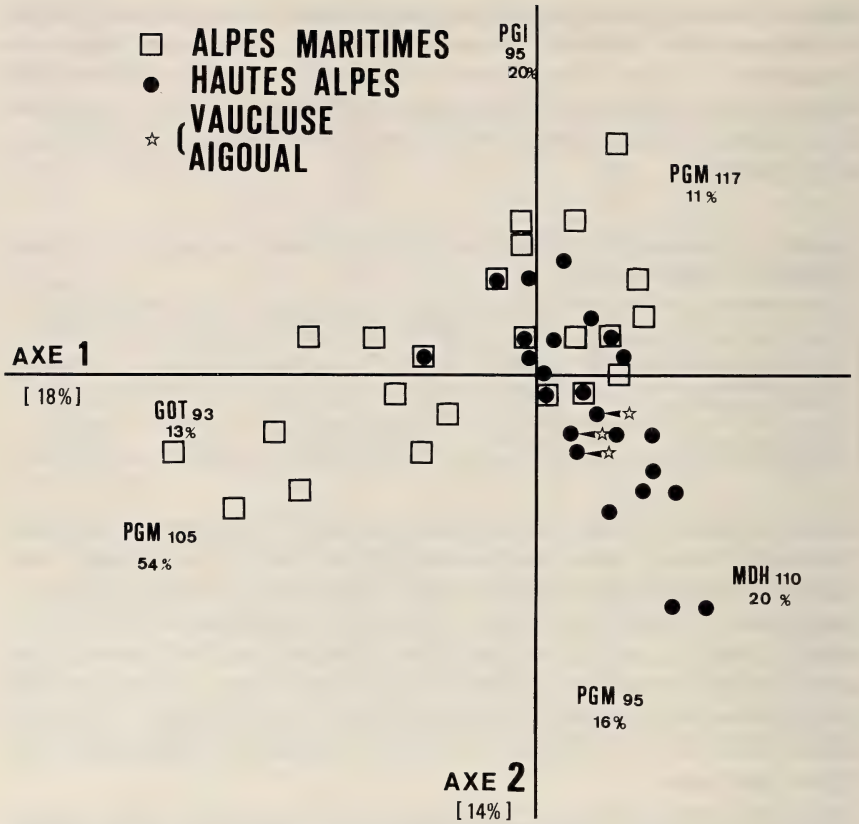

Fig. 1. Projection des individus et des allèles dans le plan 1-2 de l'analyse factorielle des correspondances.

l'avons vu, ne montrent pas d'originalité génétique décelable dans nos échantillons.

Les populations des Hautes Alpes, bien que très polymorphes, ne présentent pas de génotypes caractéristiques mais semblent constituer un «melting pot génétique» peu différencié.

3) *Analyse biométrique* : Les aplatissements moyens sont le plus souvent inférieurs à 3 (Tableau 5). Dans ces conditions, la variabilité phénotypique est assez prononcée ; ce qui semble bien s'accorder, en première approximation, avec la prolifération des sous-espèces décrites chez *P. apollo*.

L'analyse factorielle discriminante (AFD) réalisée sur les individus montre effectivement trois groupes géographiques distincts : les papillons

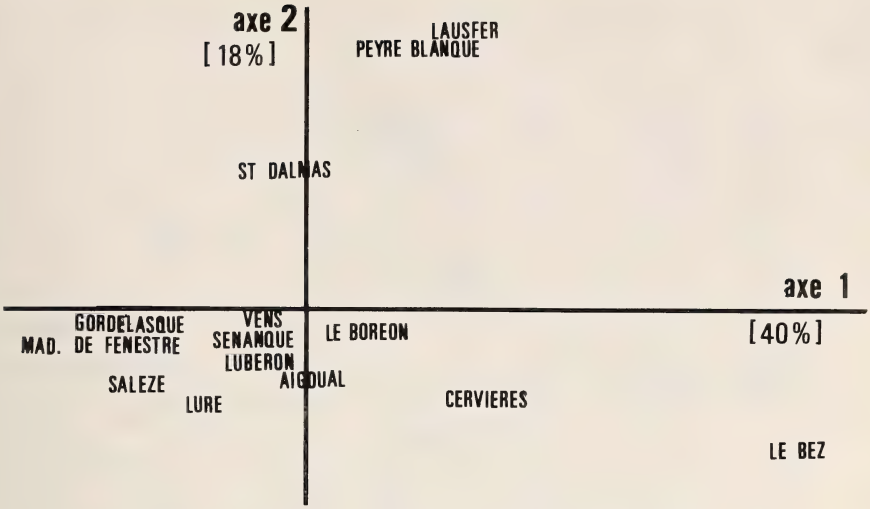

Fig. 2. Projection des populations soumises à l'électrophorèse dans le plan 1-2 de l'analyse en composantes principales selon les fréquences alléliques. Les points réels sont situés exactement sous le milieu de l'intitulé de chaque localité.

des Alpes Maritimes, ceux du Massif Central et ceux des Alpes du Nord (Figure 4). Ce résultat peut être rapproché de celui obtenu par l'électrophorèse. Cependant, si les papillons du Massif Central sont bien individualisés selon les critères biométriques, ils ne l'étaient pas d'un point de vue enzymatique. En effet, les pourcentages de recouvrement des nuages atteignent à peine 10% ; ce qui signifie qu'un papillon sur dix seulement ne présente pas les caractéristiques propres à sa région géographique. Les papillons du Massif central étudiés apparaissent ainsi caractérisés par une taille plus importante de l'aile antérieure et de la tache anale alors que ceux des Alpes Maritimes paraissent plus mélanisés.

L'ACP (analyse en composantes principales) réalisée sur l'ensemble des individus récoltés et sur ceux de collection confirme le rôle de ces caractères dans l'individualisation des groupes (Figures 5 et 6). Ainsi les colonies de Peyre Blanque, de Saint Dalmas, mais aussi celles des Pyrénées apparaissent caractérisées par l'intensité de la mélanisation entourant les ocelles rouges des ailes postérieures. L'importance de la taille des ailes des populations de l'Aigoual et de la Lozère est aussi bien visible dans la figure 5. Les populations des Alpes centrales gardent leur manque d'originalité.

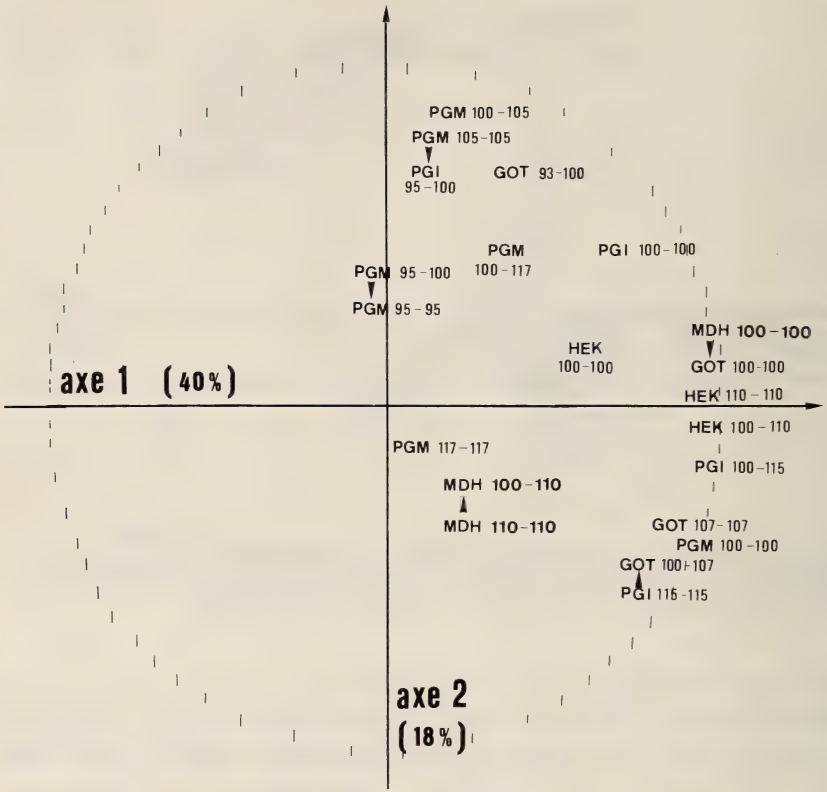

Fig. 3. Cercle principal des corrélations entre les génotypes observés et les deux premiers axes de l'analyse en composantes principales.

Discussion

Les résultats qui viennent d'être exposés permettent d'apporter des éléments de réponse préliminaires aux questions formulées dans l'introduction.

Les populations les plus vulnérables sont, sans aucun doute, situées dans le Massif Central siliceux : bordure Est (Du Forez à l'Aigoual) et axe Puy de Dôme-Cantal.

Dans le Massif Central calcaire, les populations, selon nos observations, semblaient encore bien implantées jusqu'en 1988 ; en particulier dans le Causse du Larzac. Le manque d'observations de 1989 et 1990 paraît lié aux conditions climatiques aberrantes mais une disparition totale et subite n'est plus à exclure après le renouvellement de l'échec en 1990.

Tableau 5. Valeurs moyennes (X) et coefficients d'aplatissement (A) des caractères alaires mesurés.

Populations (apl. moyen)	MOC		MPD		TIB		MBC		TA		DPG	
	X	A	X	A	X	A	X	A	X	A	X	A
Lausfer (2,65)	37,9	2,83	28,8	1,74	32,9	2,69	21,9	2,05	49,3	3,55	34,8	2,23
Le Bez (3,28)	39,0	2,81	27,3	2,75	34,8	3,11	17,1	2,25	45,6	5,29	35,6	4,1
Peyre Blanque (2,99)	38,2	2,59	29,3	2,79	33,6	4,31	23,0	3,54	48,2	4,92	40,4	2,33
Saint Dalmas (3,06)	39,8	8,74	28,8	2,73	34,9	2,34	22,2	2,64	47,6	2,58	39,6	4,31
Lac de Vens (2,62)	35,8	3,12	25,8	2,3	30,09	3,56	19,1	2,12	45,5	4,85	35,8	2,75
Aigoual (2,90)	39,4	2,02	26,1	2,5	39,4	2,07	22,6	2,18	52,9	3,84	40,8	3,29
Le Boréon (2,84)	37,7	2,15	24,8	2,93	31,1	4,23	18,7	2,82	48,5	2,99	36,6	2,21
Jura (2,72)	35,00	2,84	25,5	2,37	30,2	2,76	15,6	3,49	46,4	3,63	39,6	1,82
Pyrénées (4,76)	39,7	5,37	29,2	4,31	38,1	2,97	24,4	2,04	52,3	4,70	64,5	17,8
Briançonnais (2,59)	37,2	1,77	26,7	1,69	35,3	2,00	26,0	1,27	49,0	2,46	39,4	1,52
Savoie (2,39)	37	1,49	27,5	2,8	38,0	2,02	27,4	2,57	51,0	2,2	41,8	2,24
Lozère (2,25)	40,3	2,81	31,5	2,03	42,4	2,79	29,8	2,82	53,8	2,39	48,5	1,8

Populations	BH		AAN		APO		BOA		NOA		NOP	
	X	A	X	A	X	A	X	A	X	A	X	A
Lausfer	34,8	2,23	39,7	1,99	23,1	2,31	9,8	2,08	5,7	2,65	8,7	5,69
Le Bez	33,6	2,87	39,8	3,15	23,6	3,18	8,3	2,72	5,2	3,49	8,0	3,62
Peyre Blanque	36,4	2,01	40,3	1,99	24,3	3,02	12,3	3,57	5,5	2,68	9,5	2,22
Saint Dalmas	37,6	2,1	40,9	2,49	23,4	1,87	5,9	1,45	5,6	2,74	8,9	2,74
Lac de Vens	32,7	2,9	38,9	2,81	23,3	1,59	5,03	1,86	4,8	2,01	8,6	1,54
Aigoual	38,4	3,52	41,9	3,18	25,0	2,73	9,10	1,91	5,8	5,44	8,9	2,14
Le Boréon	33,8	3,84	40,1	2,08	24,2	3,47	8,80	1,87	4,6	3,78	8,2	1,74
Jura	31,0	2,34	40,4	3,55	22,8	1,95	7,90	2,73	4,8	3,14	7,5	2,07
Pyrénées	36,2	1,85	42,9	2,35	24,5	2,83	6,4	1,78	6,3	4,43	10,1	6,77
Briançonnais	34,4	2,83	40,1	1,73	22,5	1,87	3,3	1,84	5,1	5,47	9,2	6,62
Savoie	33,9	1,98	39,9	2,42	22,5	2,19	4,9	2,13	5,8	2,67	7,6	3,92
Lozère	39,6	3,00	45,8	1,73	27,1	2,37	8,4	1,42	4,4	2,07	6,3	1,83

MDC : Macule discocellulaire.
MPD : Macule postdistale.
T1B : Tache en 1b
MSC : Macule subcostale.
TA : Tache anale.
OPG : Grande dimension de l'ocelle postérieur.

BH : Bande hyaline.
AAN : Longueur de l'aile antérieure.
APO : Largeur de l'aile postérieure.
BOA : Blanc dans l'ocelle antérieur.
NOA : Noir dans l'ocelle antérieur.
NOP : Noir dans l'ocelle postérieur.

Fig. 4. Projections des individus sur le plan principal de l'analyse discriminante effectuée à partir de la biométrie d'individus mâles provenant de Haute Savoie (cercles noirs), des Alpes Maritimes (carrés blancs) et des Causses (triangles noirs).

Dans les Alpes du Sud, s'il peut y avoir, par places, des restrictions des surfaces des habitats, les papillons restent, dans toutes les régions, fort abondants.

Les populations du Vaucluse ne paraissent pas, elles non plus, très vulnérables, même si leur aire de distribution est plus réduite que celle des colonies alpines.

Le point n'a pas encore été fait dans le Jura, les Vosges et les Pyrénées.

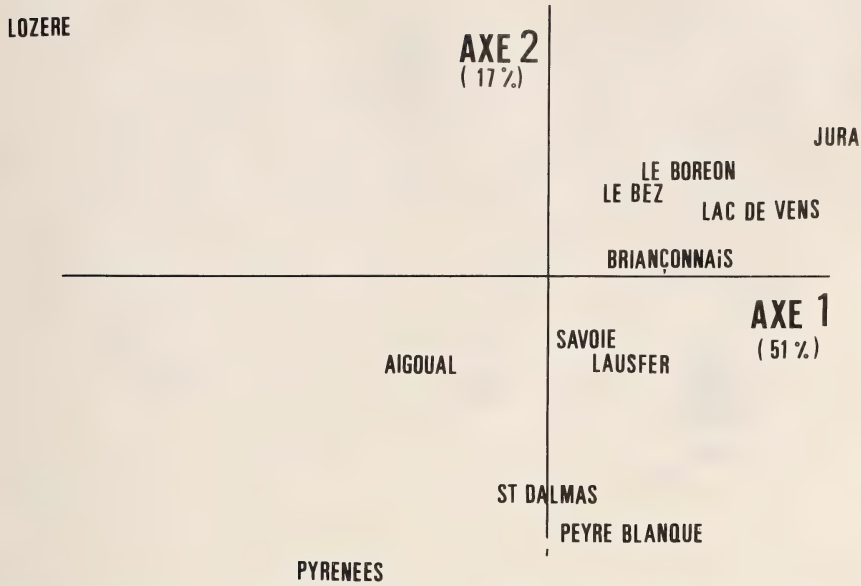

Fig. 5. Projection de l'ensemble des populations étudiées par biométrie dans le plan principal de l'analyse en composantes principales.

Le problème posé par l'originalité génétique des populations menacées est plus complexe. Si l'on s'en tient aux résultats de l'électrophorèse, la population de l'Aigoual, peu hétérozygote, ne possède pas d'allèles particuliers. Il semble en être ainsi de toutes les colonies isolées étudiées.

En fait, le type de polymorphisme révélé par les méthodes électrophorétiques ne peut généralement pas être relié à des forces sélectives évidentes. La variation géographique observée s'expliquerait surtout par des facteurs historiques liés à la dispersion plus ou moins récente des papillons.

Ainsi une hypothèse importante peut être inférée de nos résultats : les populations isolées que nous avons étudiées sont jeunes et leur différenciation enzymatique a eu lieu essentiellement par dérive. Le plan 1-2 de l'AFC (analyse factorielle des correspondances) est, à ce titre éloquent : les individus de l'Aigoual et du plateau du Vaucluse auraient pu être capturés dans les Hautes Alpes. Les mutations, dont le rythme est bien plus lent, n'ont pas amené de différenciation génétique sensible.

Au contraire, nous avons observé une variabilité importante au niveau du graphisme alaire empiriquement codifié par les descripteurs des sous-espèces. Des forces sélectives ont pu, sans doute, amener rapidement

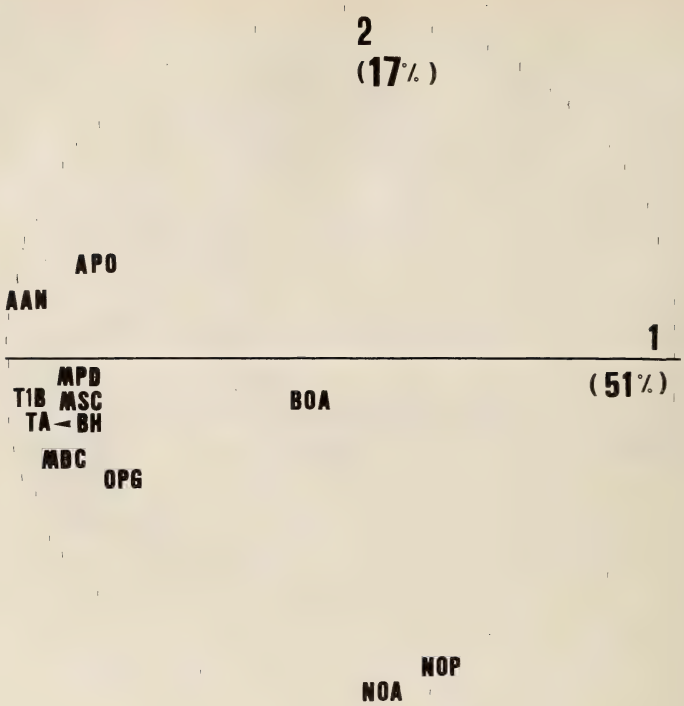

Fig. 6. Cercle principal des corrélations entre les caractères phénotypiques mesurés et les deux premiers axes de l'ACP.

une telle variation géographique bien visible sur certains caractères (taille des ailes et des ocelles, importance de la mélanisation).

Soulignons en effet que la composante génétique d'un tel déterminisme n'est point absente chez les *Parnassius*, comme le montre un travail récent (Guppy, 1989) et nos observations. Ainsi, si les populations isolées et menacées sont peut-être sans originalité biochimique marquée, une part de leur génome apparaît plus «réactif» aux pressions du milieu. Sauvegarder ces colonies revient donc à préserver des papillons qui, par leur graphisme alaire et leur éthologie, témoignent de la potentialité adaptative de l'espèce.

Un exemple de différenciation comportementale a, en effet, été observé par nous-mêmes lors de nos élevages : les Apollons de localités pentues préfèrent les sites de ce type alors que les papillons provenant des Causses se tiennent sur terrain plat.

De telles observations sont à mettre en relation avec le résultat des travaux d'Ehrlich (1983) qui postule que chaque population possède

sans doute ses propres «microadaptations». Notre tentative infructueuse d'implantation d'œufs de *P. apollo* des Causses à la Sainte Baume semble être, à ce titre, très significative (Descimon et Vesco, 1989). De même, les travaux de Palik (1980) montrent les difficultés des réintroductions, en particulier en l'absence d'une régénération des biotopes. L'étude très poussée de Richarz et col. (1989) souligne également le rôle capital de la destruction des localités favorables dans l'extinction de *P. apollo*.

Devons nous, pour autant, envisager une protection totale de chacune des localités de *P. apollo* ?

Nous ne le pensons pas. Les populations alpines sont, le plus souvent, très denses et, d'après nos résultats d'électrophorèse, très polymorphes. Elles ne paraissent donc pas menacées. Sans doute, cependant, le maximum doit-il être entrepris pour protéger le plus possible de colonies dans les localités vulnérables.

Ainsi, il semble nécessaire d'empêcher l'envahissement des stations connues de *P. apollo* dans le Massif Central siliceux par les genêts. De même, faut-il très vraisemblablement songer à contrôler, si possible, l'extension touristique dans l'axe Puy de Dôme-Cantal si l'on veut éviter l'extinction de l'Apollon dans cette région. En effet, il nous a paru déceler chez *P. apollo*, à partir de nos électrophorèses préliminaires, une structure de populations ouverte. Ce serait un facteur assez inquiétant, car de telles espèces tolèrent très mal les faibles densités et ont alors tendance à s'effondrer (Descimon et Napolitano, 1989).

Des études beaucoup plus approfondies sont donc nécessaires, tant dans les régions déjà prospectées que dans d'autres (Pyrénées, Jura...). Des observations proprement écologiques menées en collaboration avec des écologistes végétaux apparaissent indispensables.

La disparition de *P. apollo* est, comme pour l'immense majorité des autres espèces, provoquée par la disparition de ses habitats. Comment maintenir ceux-ci, dans des conditions économiques acceptables, est un problème difficile.

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Nota lepid. 13 (2-3) : 177-185 ; 30.IX.1990 ISSN 0342-7536

Die von Rothschild, L. D., in Seitz, A., Die Großschmetterlinge der Erde, Bd. 10, beschriebenen *Spilosoma*-Arten (Lepidoptera, Arctiidae) (Spilosomen-Studien 4)

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Summary

The specimens figured in Seitz, vol. 10, (1914) on plates 20-25 are identified by consecutive numbers on red square-labels. Lectotypes of all valid *Spilosoma*-taxa, described by Rothschild in this part of Seitz (*japonensis* Rothschild, 1914 ; *orientalis* Rothschild, 1914 ; *hampsoni* Rothschild, 1914 ; *persimilis* Rothschild, 1914 ; *elongata* Rothschild, 1914 ; *hypsoides* Rothschild, 1914) are designated.

Zusammenfassung

Das System zur Identifizierung der in Seitz, Bd. 10 (1914) auf den Tafeln 20-25 abgebildeten Exemplare wird beschrieben, es handelt sich um fortlaufende Zahlen auf rotem quadratischem Zettel. Lectotypen aller in diesem Teil des Seitz von Rothschild beschriebenen validen *Spilosoma*-Taxa (*japonensis* Rothschild, 1914 ; *orientalis* Rothschild, 1914 ; *hampsoni* Rothschild, 1914 ; *persimilis* Rothschild, 1914 ; *elongata* Rothschild, 1914 ; *hypsoides* Rothschild, 1914) werden festgelegt.

Allan Watson (BMNH) danke ich für den kollegialen Rat und die Hilfe bei der Einsichtnahme des Materials, Wolfgang Nässig für die redaktionellen Hilfen.

Bei der Durchsicht der im Britischen Museum (Natural History), London, befindlichen *Spilosoma* (s.l.) — Typen fiel auf, daß Typen der von Rothschild in Seitz, Bd. 10 (1914) beschriebenen Taxa der Gattung *Spilosoma* auf Anhieb nicht auffindbar waren ; dies ist umso verwunderlicher, als Rothschild üblicherweise seine Typen mit großen roten oder rosa Etiketten versah. Die Beschreibung des jeweiligen Taxon basierte in allen Fällen nicht auf Holotypen, so daß sich die Notwendigkeit ergab, Lectotypen auszuwählen bzw. im vorhandenen Material erst einmal zu suchen. Da in einer Reihe von Fällen Ab-

bildungen in Seitz vorhanden waren, konnte nach ähnlich aussehenden Exemplaren gesucht werden.

Einige *todara*-Männchen zeigten Ähnlichkeit mit der Abbildung der gesuchten *hampsoni* Rothschild in Seitz, Tafel 21d. Eins der Männchen trug ein ungewöhnliches Etikett, eine handgeschriebene „69" auf etwa quadratischem kleinen roten Zettel. Auf der Suche nach den anderen Rothschild-Taxa fanden sich weitere Falter, die ähnliche Etiketten trugen, aber nur in den Fällen, in denen Abbildungen in Seitz existierten. Die Zahlenunterschiede entsprachen den Unterschieden bei einer gedachten fortlaufenden Numerierung der entsprechenden Falter auf den Tafeln in Seitz. Weitere Suche in den Beständen des Museums brachte eine Vielzahl von Faltern, die in dieses System paßten.

Als Zusammenfassung der Recherchen ergeben sich folgende Erkenntnisse: Ein Teil der Arctiiden-Falter, die den Abbildungen in Seitz, Bd. 10, zugrundeliegen, lassen sich einwandfrei durch ein quadratisches rotes Etikett mit einer handgeschriebenen Nummer identifizieren. Dabei hat *nexa* ♂ auf Tafel 20 links oben die Nummer „1". Fortlaufend von links nach rechts (*vigens* „2", *lacteatum* ♂ „3" etc.) und von oben nach unten sind alle Falter durchnumeriert. Dies setzt sich auf Tafel 21 fort mit „51" für *flavens* ♂, auf Tafel 22 für *multiguttata* „90" etc. Die Numerierung endet mit „251" für *alba* auf Tafel 25 unten rechts. Es sind also Falter eindeutig identifizierbar, die als Vorlage für die Abbildungen auf den Tafeln 20 bis 25 dienten. Obwohl eine Suche nach allen 251 Exemplaren aus Zeitgründen nicht erfolgen konnte, brachten stichpunktartige Kontrollen nur eine einzige Lücke: bei den auf Tafel 23 abgebildeten Arten ab *phasiana* (*khasiana*, d. Verf.) scheinen die Zettel mit den Nummern entfernt worden zu sein.

Die Konsequenz dieser Erkenntnisse für die von Rothschild in Seitz, Bd. 10 (1914) neu beschriebenen Taxa ist im nachfolgenden systematischen Teil dargestellt.

Die Bedeutung der roten Etiketten ist nur teilweise nachvollziehbar. Sie wurden mit Sicherheit nicht im BMNH, London, gefertigt, sind also nicht von Rothschild selbst angebracht worden. Die Zahlen stammen nach Ausssage von Allan Watson aus einer „kontinentalen Feder", wie aus der Art, wie bestimmte Ziffern geschrieben sind, geschlossen werden kann. Wahrscheinlich waren sie eine Sortierhilfe für den deutschen Zeichner der Tafeln und verblieben nach Rücksendung nach London an der jeweiligen Nadel. Warum gerade die vorliegenden Falter durchnumeriert wurden und nicht auch die Spilosomen der Tafel 19, oder alle Arctiiden, bleibt unerklärt.

Systematischer Teil

Die folgenden Lectotypus-Festlegungen der *Spilosoma*-Arten sind in der Reihenfolge der Arten in SEITZ, Bd. 10 (1914) geordnet, jeweils zunächst mit Seitenzahl in SEITZ und Originalzitat.

1. S. 239 : „*D. rhodophila* WKR. *japonensis* subsp. nov. (21e)".

Bemerkungen.

Ein mit einem Typenetikett versehenes Exemplar von *japonensis* ROTHSCHILD existiert in coll. BMNH nicht. Das in 21e abgebildete Männchen ist durch Nr. „72" auf rotem quadratischem Zettel eindeutig identifizierbar. Es wird hiermit zum Lectotypus festgelegt (Abb. 1-3).

DESIGNATION. Der Lectotypus von *japonensis* ROTHSCHILD ist ein in der Grundfarbe sehr blasses, cremeweißes Männchen von *inaequalis* BUTLER, auch Größe und Flügelschnitt stimmen mit *inaequalis* überein. Damit wird die entsprechende Vermutung DANIELS (1943) bestätigt. Die von DANIEL unter *Spilarctia japonensis* ROTHSCHILD behandelten Falter aus der Mandschurei gehören nicht zu *inaequalis*, sondern zu *melli* DANIEL.

Diese Artengruppe wurde inzwischen zu *Lemyra* gestellt (THOMAS 1990).

Status :

Lemyra inaequalis (BUTLER 1879).
Diacrisia rhodophila japonensis ROTHSCHILD 1914.
Spilarctia japonensis ROTHSCHILD (DANIEL 1943), partim.

2. S. 243 : „*D. obliqua* WKR. *occidentalis* subsp. nov. (21e)".

Bemerkungen.

In coll. BMNH befindet sich unter dem Schild „*occidentalis*" ein Weibchen mit der Etikettierung „Haining 10/92", „Walker Coll. 91-155" und „*Diacrisia obliqua* var. *occidentalis* Roths. Hampson Ab. 1". Ich wähle aber das der Abbildung 21e in SEITZ zugrunde liegende Weibchen zum Lectotypus (Abb. 4-6).

DESIGNATION. Es trägt die Zahl „71".

Die von ROTHSCHILD als *occidentalis* angesehenen Weibchen sind Weibchen von *bisecta* LEECH. In der Meinung, einige gute Arten als Formen oder Synonyme unter *obliqua* zusammenfassen zu können, fielen ROTHSCHILD die *bisecta*-Weibchen gegenüber normalen „*obliqua*" als Farbvarianten auf. Die Färbung von *bisecta*-Weibchen reicht von

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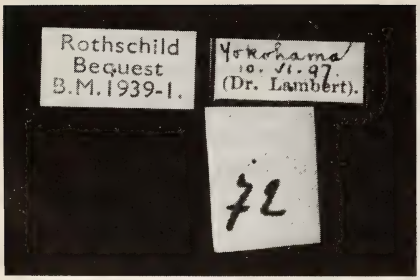

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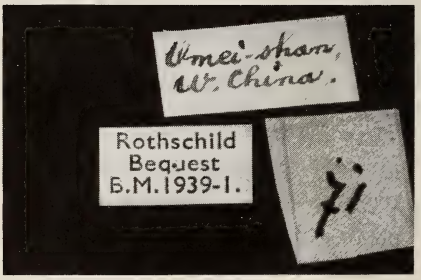

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Abb. 1. *D. rhodophila japonensis* Rothsch. Lectotypus, Oberseite.
Abb. 2. *D. rhodophila japonensis* Rothsch. Lectotypus, Unterseite.
Abb. 3. *D. rhodophila japonensis* Rothsch. Lectotypus, Etiketten.
Abb. 4. *D. obliqua occidentalis* Rothsch. Lectotypus, Oberseite.
Abb. 5. *D. obliqua occidentalis* Rothsch. Lectotypus, Unterseite.
Abb. 6. *D. obliqua occidentalis* Rothsch. Lectotypus, Etiketten.

fahlgraubraun bis deutlich mittelbraun. Die Beschreibung von *occidentalis* als Subspecies ist wohl darauf zurückzuführen, daß ROTHSCHILD „normale *obliqua*“ aus West-China nicht vorlagen.

DANIEL (1943) erkannte die Eigenständigkeit von *bisecta* und die Zuordnung von *occidentalis* zu dieser, doch ist der Subspecies-Charakter von *occidentalis* offensichtlich nicht aufrecht zu erhalten. Sowohl das äußere Erscheinungsbild des Typenmaterials beider Taxa als auch die geographische Verbreitung sprechen dagegen.

Status :

Spilosoma bisecta LEECH 1888.
Diacrisia obliqua occidentalis ROTHSCHILD 1914.
Spilarctia bisecta occidentalis ROTHSCHILD (DANIEL 1943). **Syn. n.**

3. S. 243 : „*D. hampsoni* spec. nov. (21d)“.

Bemerkungen.

Ein etikettiertes Exemplar ist in coll. BMNH nicht vorhanden. Das der Abbildung 21d in Seitz zugrundeliegende Exemplar trägt der Rangfolge auf der Tafel entsprechend die Nummer „69“. Es wird hier als Lectotypus festgelegt (Abb. 7-9).

DESIGNATION. Die Zeichnungsanlage und Färbung des Falters entsprechen weitgehend der Abbildung und Beschreibung.

Der Lectotypus von *hampsoni* ist ein Männchen von *todara* MOORE. Möglicherweise stand ROTHSCHILD wenig Vergleichsmaterial zur Verfügung. Die heute in coll. BMNH befindliche Serie von *todara* weist eine erhebliche Variationsbreite auf, in die *hampsoni* hineinpaßt. Welche Falter ROTHSCHILD mit den Weibchen in der Urbeschreibung gemeint haben könnte, ist nicht mehr nachvollziehbar.

Status :

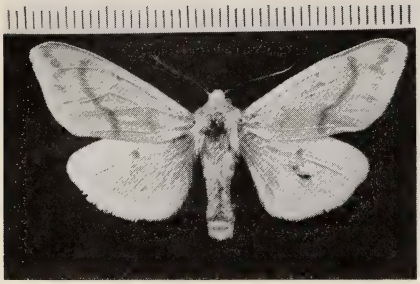
Spilosoma todara MOORE 1872.
Diacrisia hampsoni ROTHSCHILD 1914. **Syn. n.**

4. S. 246 : „*D. persimilis* spec. nov. (22f, g)“.

Bemerkungen.

Aus der Syntypen-Serie, die 14 Männchen und 1 Weibchen umfaßt, wähle ich das Männchen mit der Nummer „118“ zum Lectotypus (Abb. 10-12).

DESIGNATION. Weitere drei Falter, 1 Männchen und zwei Weibchen, gefangen in den 30er Jahren dieses Jahrhunderts, wurden coll. BMNH später zugefügt.



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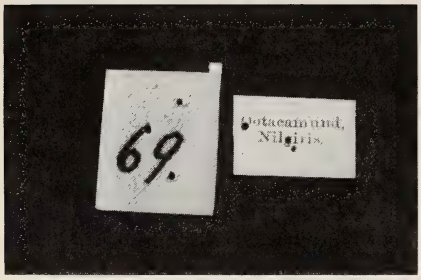

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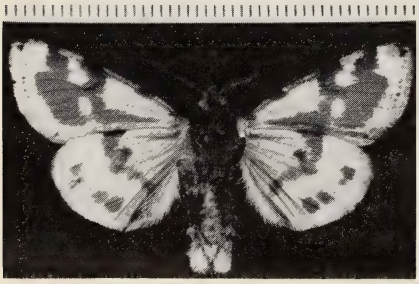

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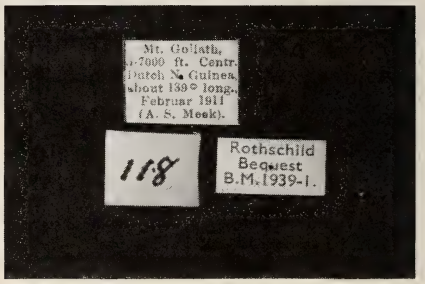

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Abb. 7. *D. hampsoni* Rothsch. Lectotypus, Oberseite.
Abb. 8. *D. hampsoni* Rothsch. Lectotypus, Unterseite.
Abb. 9. *D. hampsoni* Rothsch. Lectotypus, Etiketten.
Abb. 10. *D. persimilis* Rothsch. Lectotypus, Oberseite.
Abb. 11. *D. persimilis* Rothsch. Lectotypus, Unterseite.
Abb. 12. *D. persimilis* Rothsch. Lectotypus, Etiketten.

Spil. persimilis ist eine der ca. 2 Dutzend in Neu-Guinea endemischen *Spilosoma*-Arten.

Status :

Spilosoma persimilis (Rothschild 1914).

5. S. 246 : „*D. biagi* B.-Bak. *elongata* subsp. nov.".

Bemerkungen.

5 Männchen sind als Syntypen anzusprechen, daraus wähle ich das Männchen mit der Nummer „131" zum Lectotypus (Abb. 13-15).

Designation. Zeichnungsunterschiede zwischen *elongata* und *biagi* sind augenfällig, aber nicht gravierend. Mangels Material läßt sich nicht beurteilen, ob die Beschreibung von *elongata* als Subspecies gerechtfertigt ist ; außer den Syntypen beider Taxa scheint kein weiteres Material bekannt geworden zu sein.

Status :

Spilosoma biagi elongata (Rothschild 1914).

6. S. 246 : „*D. hypsoides* spec. nov. (23g)".

Bemerkungen.

Spil. hypsoides gehört zu den Arten auf Tafel 23, bei denen mit rotem Etikett versehene Exemplare nicht aufzufinden waren. Statt dessen trägt ein Falter ein weißes Etikett mit der Aufschrift „*Spilosoma hypsoides* Rothschild Type", ein Etikett, wie es Rothschild in seinen späten Jahren zur Typenetikettierung benutzte ; auch die Handschrift deutet darauf hin, daß das Etikett von Rothschild selbst stammt. Unter den drei Syntypen lege ich dieses Exemplar zum Lectotypus fest (Abb. 16-18).

Designation. Trotz der Ähnlichkeit in Färbung und Zeichnung hat *hypsoides* nichts mit der *niceta*-Gruppe zu tun. Nach dem Genitalapparat zu urteilen, scheint die Art vorläufig isoliert zu stehen.

Status :

Spilosoma hypsoides (Rothschild 1914).

7. Die anderen von Rothschild in Seitz, Bd. 10, aufgestellten *Spilosoma*-Taxa sind infrasubspezifisch (eindeutig als Aberrationen gekennzeichnet) und haben daher keine nomenklatorische Gültigkeit. Sie sind im folgenden aufgelistet :

Spilosoma erythrastis Moore ab. *diluta* ; Rothschild 1914.
Lemyra stigmata (Moore) ab. *aurantiaca* ; Rothschild 1914.

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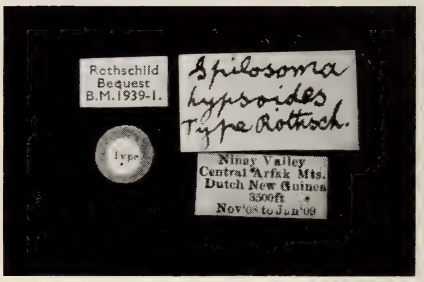

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Abb. 13. *D. biagi elongata* ROTHSCH. Lectotypus, Oberseite.
Abb. 14. *D. biagi elongata* ROTHSCH. Lectotypus, Unterseite.
Abb. 15. *D. biagi elongata* ROTHSCH. Lectotypus, Etiketten.
Abb. 16. *D. hypsoides* ROTHSCH. Lectotypus, Oberseite.
Abb. 17. *D. hypsoides* ROTHSCH. Lectotypus, Unterseite.
Abb. 18. *D. hypsoides* ROTHSCH. Lectotypus, Etiketten.

Spilosoma leopardina (Kollar) ab. *suffusa* ; Rothschild 1914.
Spilosoma casigneta (Kollar) ab. *melanocephala* ; Rothschild 1914.
Spilosoma casigneta (Kollar) ab. *xanthogaster* ; Rothschild 1914.
Spilosoma rubilinea Moore ab. *fuscescens* ; Rothschild 1914.
Spilosoma strigatula (Walker) ab. *apuncta* ; Rothschild 1914.

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Rothschild, L. W., 1914. V. Subfamilie Arctiinae. In Seitz, A. (Ed.) : Die Großschmetterlinge der Erde, Bd. 10 : 236-263. Kernen-Verlag, Stuttgart.

Thomas, W., 1990. Die Gattung *Lemyra* (Lep., Arct.). *Nachr. entomol. Ver. Apollo*, Frankfurt, Suppl. 9 : 1-83.

Nota lepid. 13 (2-3) : 186-187 ; 30.IX.1990 ISSN 0342-7536

Book reviews — Buchbesprechungen — Analyses

LARSEN, T. B. 1990 : The Butterflies of Egypt. Apollo Books, Lundbyvej 36, DK-5700 Svendborg Danemark. 112 pages, 8 planches couleur. DK 240.- plus port.

Après avoir ré-édité de façon magistrale (planches en couleurs) les ouvrages classiques de CULOT (Noctuelles et Géomètres) et SPULER (Microlépidoptères, Chenilles) devenus introuvables ou hors de prix, notre collègue et membre de la SEL Peder SKOU édite maintenant (Apollo Books) un très beau nouveau livre en anglais sur les Diurnes d'Égypte.

L'auteur de «The Butterflies of Egypt», également membre de notre SEL, également Danois : Torben B. LARSEN, s'est distingué comme spécialiste des Rhopalocères et Hesperiidae (Lépidoptères diurnes) du Proche- et du Moyen-Orient. Rappelons ici ses nombreux travaux déjà publiés : Butterflies of Lebanon 1974, Butterflies of Eastern Oman 1977, Butterflies of Dhofar 1980, Butterflies of the Yemen Arab Republic 1982, Insects of Saudi Arabia Rhopalocera 1983, Butterflies of Saudi Arabia and its neighbours 1984, Butterflies of Oman 1980, enfin (avec I. Nakamura) Butterflies of East Jordan 1983.

Il a en outre actuellement à l'impression (Oxford University Press) un livre sur les Rhopalocères et Hesperiidae du Kenya, qui traitera des 870 espèces de ce pays. Son nouveau livre, très bien présenté sur papier glacé, de format élégant et agréable, avec une belle jaquette en couleur (*Hypolimnas misippus* L. ♂) est dédié à E.P. WILTSHIRE. Sur 112 pages et 8 planches en couleur (photos), il présente de façon claire, complète mais concise, les 58 espèces recensées jusqu'à présent de façon certaine sur le territoire de l'Égypte : du Sinaï au désert occidental et au Gebel Elba au sud. Comme il se doit, les chapitres successifs sont les suivants : Géographie de l'Égypte, subdivisions écologiques, histoire des recherches lépidoptérologiques en Égypte ; puis vient la partie centrale : liste systématique des 58 espèces, avec pour chacune d'entre elles sa répartition, son statut (ssp.) et nombre de renseignements utiles : biologie, écologie, au besoin caractères distinctifs (au total 37 pages). Viennent ensuite : Une liste commentée des espèces qui pourraient encore être trouvées en Égypte, des espèces dont l'absence est surprenante et des espèces citées par erreur ; biogéographie des Diurnes d'Égypte (éléments afro-tropicaux, orientaux, paléotropicaux, paléarctiques, érémiques et indéterminés) ; répartition des espèces entre les sept principales zones écologiques ; migrateurs; les huit planches ; espèces nuisibles ; bibliographie (7 pages) ; index alphabétique.

Rédigé en langage courant et non technique, alors même qu'il satisfait entièrement aux critères scientifiques les plus récents, cet ouvrage permet d'identifier

toutes les espèces de Diurnes égyptiens, peu nombreuses mais extrêmement intéressantes.

À propos de la bibliographie, je regrette personnellement l'absence du Comte Turati. À la page 21 (Chapitre «Régions voisines»), Larsen écrit que la République Arabe de Libye, pays voisin à l'ouest, a fait l'objet de quelques recherches, ayant abouti à plusieurs publications du Comte Turati, dispersées dans la littérature entomologique italienne, mais jamais complètement «digested». Et il ajoute (avec raison) qu'une revue de la faune de Lybie serait hautement désirable. Or les travaux de Turati sur les Lépidoptères de Cyrénaique ne sont nullement dispersés, mais tous concentrés dans les deux grandes revues scientifiques nationales italiennes : *Atti Soc. ital. Sc. Nat.* : 7 travaux importants sur les Lépidoptères de Cyrénaique, de 1921 à 1930, et *Mem. Soc. Entom. Ital.* : 1 travail (avec G. Krüger) en 1936 sur le même sujet, ainsi que dans *Boll. Mus. Zool. Torino*, 1925 (1 travail sur le même sujet).

Ayant la chance de posséder les tirages à part de tous les travaux du Comte Turati, j'ai pu constater la grande richesse des données qu'on y trouve sur les Diurnes (entre autres familles) de Cyrénaique : plus de 25 espèces, dont quelques nouvelles, et quantité de «formes». Je suis convaincu que ces travaux pourraient précisément servir de base à la revue hautement désirable pour Larsen. Dommage qu'aucun d'entre eux ne figure dans la bibliographie !

Malgré cette regrettable omission, c'est un véritable plaisir que de tenir ce livre en main et d'en étudier les divers chapitres. À tous nos lecteurs qui se rendront en Égypte pour leur pélerinage culturel aux sources de la civilisation, nous recommandons le «Larsen-Égypte» comme agréable lecture de voyage. Et bien entendu, cette monographie devrait figurer sur les rayons de bibliothèque de tout lépidoptériste européen qui sait regarder au delà des frontières de son pays.

E. de Bros.

Communication

Aufruf um Mitarbeit

Mitarbeiter des Tiroler Landesmuseum Ferdinandeum erarbeiten derzeit eine Rote Liste der gefährdeten Tiere Südtirols (Schmetterlinge). Es wird ersucht Sammellisten für diesen Zweck zur Verfügung zu stellen.

Anschrift : Dr P. Huemer, Tiroler Landesmuseum, Museumstrasse 15, A-6020 Innsbruck.

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Editorial

L'Assemblée générale des membres qui s'est tenue à Lunz am See le 5 septembre 1990 pendant le 7ème Congrès européen de Lépidoptérologie a donné suite à la proposition du Conseil pour l'élection du Directeur des publications. Lors des dernières séances du Conseil, j'avais en effet demandé à être «mis à la retraite» et déchargé de cette responsabilité pour raison d'âge — 77 ans — après 10 ans d'activité.
Comme je le souhaitais, le nouveau Comité de rédaction est donc formé de trois membres résidant en Suisse près de Bâle, condition requise pour assurer le contact permanent entre eux (séances du Comité de rédaction) : Steven Whitebread, directeur des publications, assisté des Dres Andreas Erhardt et Hansjürg Geiger, co-rédacteurs. Tous trois jeunes, dynamiques, lépidoptérologistes enthousiastes, hautement qualifiés et déjà bien connus par leurs nombreuses publications, ils vont assurer à notre société une revue digne de nos ambitions, spécialement dans les domaines d'actualité tels que la conservation des espèces et leurs biotopes.
Ayant assisté pendant 10 ans à l'augmentation du nombre des membres et abonnés à Nota lepidopterologica : de moins de 400 à plus de 600, et connaissant bien la nouvelle équipe pour avoir travaillé avec elle ces quatre dernières années, je peux me retirer en toute confiance «in otium cum dignitate» et prends ici congé avec regret des nombreux et sympathiques auteurs et lecteurs avec lesquels j'ai eu le plaisir et l'honneur d'être en contact pendant cette période.

At recent meetings of the Council, I asked to be relieved of my responsibilities as Editor of Nota lepidopterologica after 10 years of activity on grounds of age (77). During the 7th European Congress of Lepidopterology in Lunz am See, the General Meeting of 5th September 1990 approved the proposal of the Council for the election of a new Editor.
As I hoped, the new Editorial Committee consists thus of three members residing in Switzerland, not far from Basle. This ensures the necessary mutual contact for the monthly Editorial Committee meetings : Steven Whitebread, Editor, with Drs Andreas Erhardt and Hansjürg Geiger, Assistant Editors. All three are young, dynamic, enthusiastic lepidopterologists, highly qualified and well known with several publications. They will edit our journal to the high standard we aim at, especially in modern fields such as species- and habitat protection.
During these 10 years, I have seen the number of our members and readers increase from less than 400 to more than 600, and also I am well aware of the qualities of the new team, having worked with them for the last 4 years. Therefore I may retire «in otium cum dignitate» confidently. Thus, with regret, I take leave here from the numerous authors and readers whom I had the honour and the pleasure of getting to know during this period.

Die Mitgliederversammlung in Lunz am See am 5. September 1990 während des 7. Europäischen Kongresses für Lepidopterologie hat dem Vorschlag des Vorstandes zur Wahl des neuen Schriftleiters zugestimmt : Anlässlich der letzten Sitzungen des Vorstandes hatte ich gebeten «pensioniert» zu werden und von dieser Verantwortung entlastet zu werden — altershalber (77 Jahre) — nach 10 Jahren Amtsführung.
Wie von mir gewünscht besteht das neue Redaktionskomitee nun aus drei Mitgliedern, welche in der Schweiz unweit Basel wohnen (Bedingung für den permanenten Kontakt : monatliche Redaktionskomitee-Sitzungen) : Steven Whitebread, Schriftleiter, und die Dres Andreas Erhardt und Hansjürg Geiger, Co-Redaktoren. Alle drei sind jung, dynamisch, begeisterte Lepidopterologen, hoch qualifiziert und bereits durch viele Publikationen wohl bekannt : sie werden für unsere Gesellschaft eine Zeitschrift herausgeben die unseren Ambitionen entspricht, besonders auf aktuellen Gebieten wie Arten- und Biotopen-Schutz.
In 10 Jahren ist die Mitglieder- und Abonnentenzahl von ca 400 auf über 600 gestiegen ; die drei Redaktoren sind mir wohlbekannt, nachdem ich während den letzten 4 Jahren mit ihnen gearbeitet habe. So darf ich mich im Vertrauen «in otium cum dignitate» zurückziehen. Mit Bedauern verabschiede ich mich also hier von den zahlreichen Autoren und Lesern mit denen ich während dieser Periode mit Stolz und Freude den Kontakt gepflegt habe.

E. de Bros

Nota lepidopterologica Vol. 14 (1991)

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Nota lepid. 13 (4) : 192-197 ; 31.XII.1990 ISSN 0342-7536

Descriptions of the larva and pupa of *Similipepsis takizawai* Arita & Špatenka (Lepidoptera, Sesiidae)

Yutaka Arita

Zoological Laboratory, Faculty of Agriculture, Meijo University, Tempaku-ku, Nagiya, 468 Japan.

It is known that the larva of *Similipepsis takizawai* Arita & Špatenka is a borer of twigs of *Betula platyphylla* Sukatchev var. *japonica* (Miquel) Hara and *B. ermanii* Chamisso, Betulaceae (Arita & Špatenka, 1988). The mature larve and pupa of this species are described and illustrated in the present paper. The morphological characters of the immature stages of the genus *Similipepsis* have hitherto been unknown.

A detailed account of the life history of this species will be given by Mr. Y. Takizawa, of the Kyushu Research Center, Forest and Forest Products Research Institute, Kumamoto, in a forthcoming paper.

I wish to express my hearty thanks to Dr. S. Moriuti, of University of Osaka Prefecture, for his kindness in correcting the original manuscript, and to Mr. Y. Takizawa for his help during my field survey of the larva of this species.

Similipepsis takizawai Arita and Špatenka, 1988 (fig. 1-6)

Matura larva (figs. 1, 2, 3) : length 15.0-22.0 mm. Width 2.0-2.5 mm. Remarkably slender. Head brown ; mouth parts light brown. Body creamy yellow ; shield light brown ; thoracic legs pale yellowish brown. Head (fig. 3a) comparatively broader than long ; coronal suture very long, longer than frons. Ocelli (fig. 3b) six, with V and VI widely separated from I-IV. Labrum (figs. 3c & d) with strong arms. Mandible (fig. 3e) with one small and three large teeth. Shield well developed. Prothoracic spiracle remarkably large and located on a very large pinaculum of L-setae. Meso- and metathorax with a small brown-pigmented spot on strongly concave central margin of a large pinaculum of L1 and L3. Spiracle of 8th abdominal segment large, about twice as large as those of the other abdominal ones. Anal shield (fig. 2) extremely large, rounded posteriorly. Ventral proleg (fig. 3i) with 33+

Fig. 1. *Similipepsis takizawai* Arita & Špatenka, mature larva inside split stem.

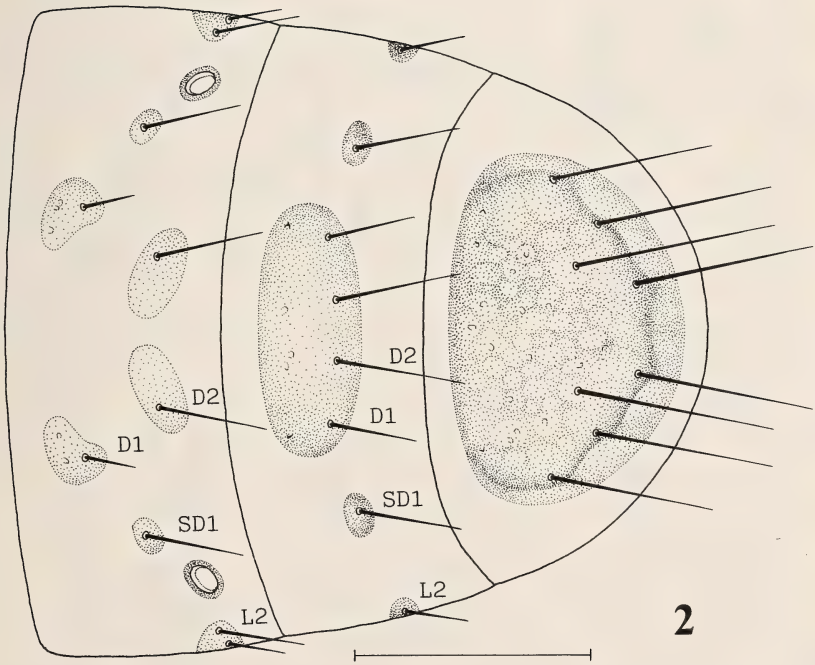

Fig. 2. *Similipepsis takizawai* Arita & Špatenka, mature larva, 8th to 10th abdominal segments, dorsal view (Scale line = 1.0 mm.).

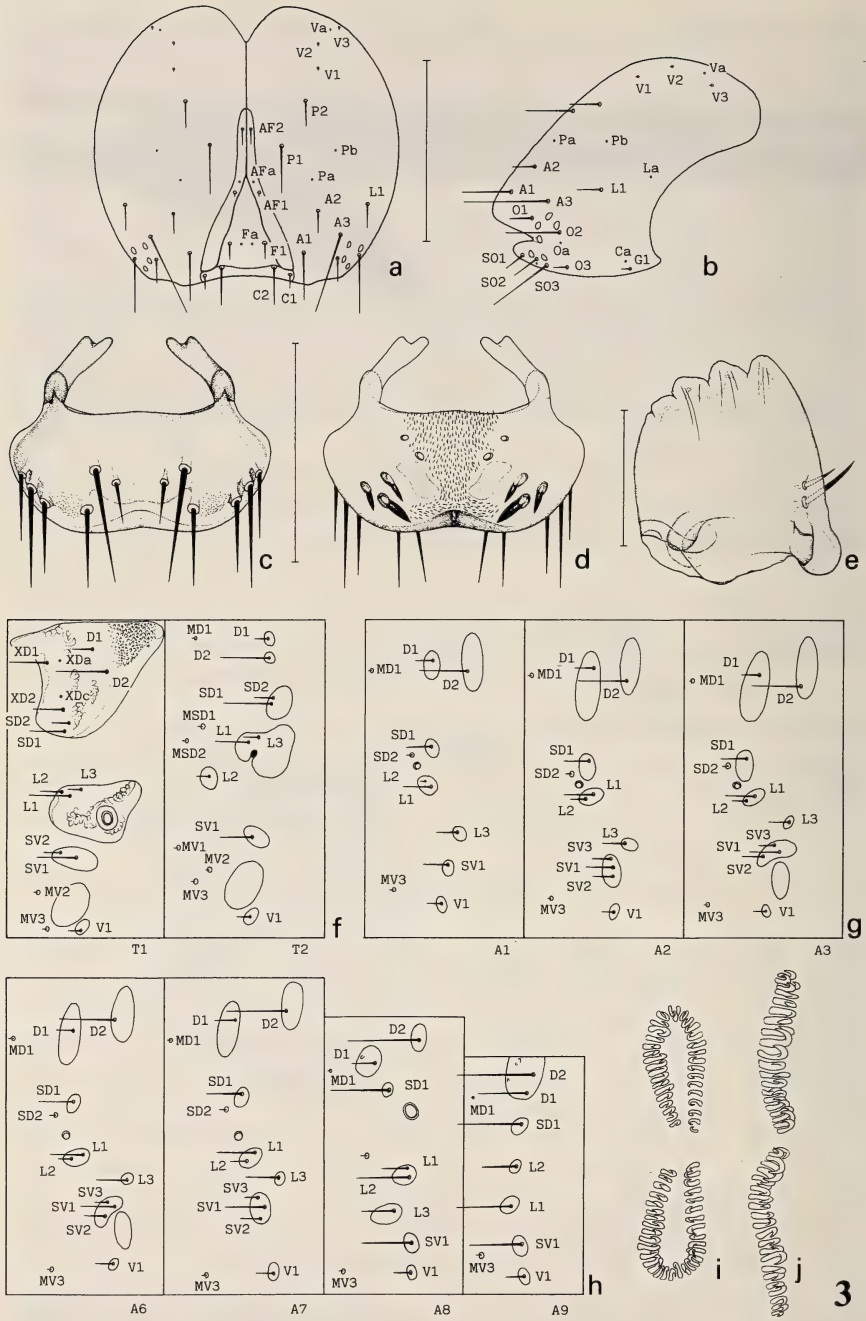

Fig. 3. *Similipepsis takizawai* Arita & Špatenka, mature larva. a) head frontal view ; b) ocellar region, left side ; c) labrum, dorsal view ; d) labrum, ventral view ; e) mandible, ventral view ; f) pro- and mesothorax ; g) first to 3rd abdominal segments ; h) sixth to 9th abdominal segments ; i) 3rd abdominal proleg, ventral view ; j) anal proleg, ventral view. (Scale line : a & b = 1.0 mm. ; c, d & e = 0.25 mm.).

crochets arranged in lateral penellipse. Anal proleg (fig. 3j) with 22+ crochets.

Chaetotaxy : Head (fig. 3a) with AF1 microscopic and distant from AF2. AFa very near to AF1. Prothorax with L setae close together, located on anterodorsal part of their common pinaculum. Meso- and metathorax with L1 and L3 on a large common pinaculum ; SV group

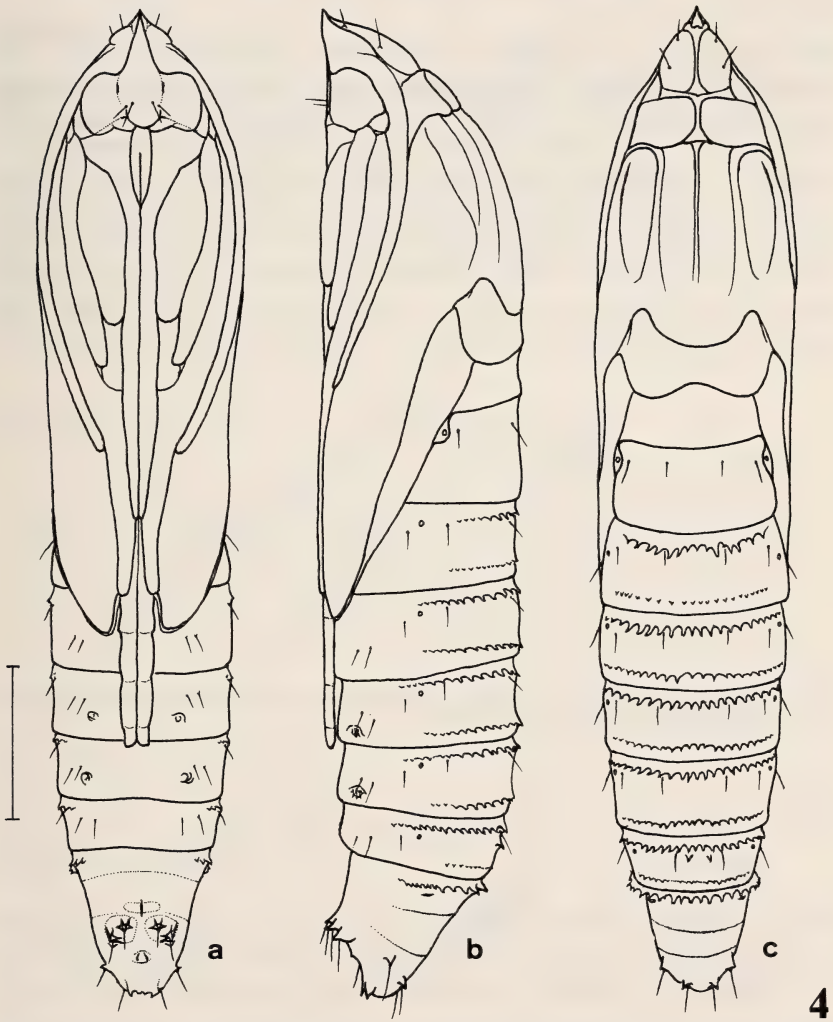

Fig. 4. *Similipepsis takizawai* Arita & Špatenka, pupa, ♂. a) ventral view ; b) lateral view ; c) dorsal view. (Scale line = 2.0 mm.).

unisetose. Abdomen : D1 and D2 with its own large pinaculum on 1st-8th segments ; 9th segment with D1 and D2 on a common pinaculum ; SV group unisetose on 1st, 8th and 9th, and trisetose on 2nd-7th segments.

MATERIAL EXAMINED : Japan : Honshu- 18 larvae, feeding within twig of *Betula platyphylla* SUKACHEV var. *japonica* (MIQUEL) HARA, Iwate-ken, Tamayama-mura, Kouma, 22.VI.1986, Y. ARITA, fixed on 23.VI.1986.

Pupa (figs. 4, 5, 6) : length 12.5-16.0 mm. Width 2.0-2.5 mm. Very slender, light brown. Frontal process (figs. 5a & b) well developed, triangular and pointed. Maxilla extremely long, about as long as half the length of body. Mesothoracic legs extending far beyond tips of maxillae. Metathoracic legs very long, extending a little beyond posterior margin of 5th abdominal segment. Wings somewhat short, the tips reaching to middle of the 4th abdominal segment. Mesothorax with alar dorsal furrows well developed. Abdominal dorsal surface with two rows of spines on 3rd-6th in female and 3rd-7th in male ; 8th segment with a single row of spines in both sexes, and in female the

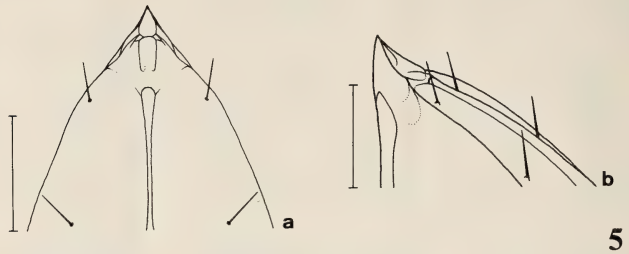

Fig. 5. *Similipepsis takizawai* ARITA & ŠPATENKA, pupal frontal process. a) dorsal view ; b) lateral view. (Scale line = 0.5 mm.).

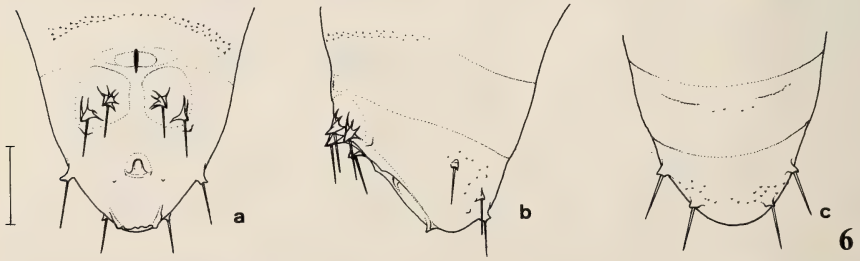

Fig. 6. *Similipepsis takizawai* ARITA & ŠPATENKA, pupa, ♂, terminal segments. a) ventral view ; b) lateral view ; c) dorsal view. (Scale line = 0.5 mm.).

row being very short and interrupted at middle. Tenth abdominal segment (figs. 6a-c) with five pairs of broad spines, *viz.*, two pairs large and broad on ventral side, a single on lateral side, and two pairs on dorsal side.

MATERIAL EXAMINED : Japan : Honshu- 8exs., reared from larvae, Iwate-ken, Tamayama-mura, Kouma, 22.VI.1986, Y. ARITA, pupated early July 1986.

Reference

ARITA, Y. & ŠPATENKA, K., 1988. A new species of *Similipepsis* (Lepidoptera, Sesiidae) from Japan. *Jpn. J. Ent.*, 57 : 61-66.

Aufruf um Mitarbeit

Mitarbeiter des Tiroler Landesmuseum Ferdinandeum erarbeiten derzeit Rote Liste der gefährdeten Tiere Südtirols (Schmetterlinge) und es wird ersucht Sammellisten für diesen Zweck zur Verfügung zu stellen.

Anschrift : Dr. P. Huemer, Tiroler Landesmuseum, Museumstrasse 15, A-6020 Innsbruck

Nota lepid. 13 (4) : 198-206 ; 31.XII.1990 ISSN 0342-7536

Contributions à la connaissance des Coleophoridae. LXII. Deux espèces nouvelles du genre *Coleophora* Hübner de la région méditerranéenne (Lepidoptera)

Giorgio Baldizzone

via Manzoni, 24, I-14100 Asti, Italie.

Résumé

Dans le présent travail, deux nouvelles espèces du genre *Coleophora* Hübner sont décrites : *C. etrusca* sp. n. du groupe de *C. mayrella* (Hübner, [1813]) et *C. mediterranea* sp. n. espèce difficile à placer dans le cadre du 30e groupe de Toll (1952) auquel elle appartient.

Summary

Two new species of the genus *Coleophora* Hübner are described : *C. etrusca* sp. n. of the *C. mayrella* (Hübner, [1813]) group and *C. mediterranea* sp. n., a member of the 30th group of Toll's system, but which is difficult to place within it.

Le travail qui suit a pour but de présenter deux espèces nouvelles du genre *Coleophora*, que j'ai découvertes en travaillant à la rédaction du volume de la «Faune d'Italie». Il s'agit de *C. etrusca* sp. n., espèce d'un vert métallique, provenant, à la fois, d'Italie centrale et d'Anatolie, et de *C. mediterranea*, espèce blanche, provenant de la région méditerranéenne occidentale.

Pour le prêt et pour le don du matériel, mes remerciements vont à M. Ernst Arenberger et au Dr Friedrich Kasy de Vienne, à M. Ernst Traugott-Olsen de Marbella (Espagne), à M. Carlo Prola de Rome et à M. Paolo Triberti de Vérone. Le Dr Pierre Viette, encore une fois, a eu l'amabilitée de revoir le texte français.

Coleophora etrusca sp. n.

Holotype ♂ (PG Bldz 10215) : «Lazio, m 380 c., Monti della Tolfa, dint. di Manziana, 23-28.VI.1989, G. Baldizzone», coll. Baldizzone.

Paratypes : 1 ♂ (PG Bldz 7335) : «Monti Albani, Pratone, 2.VII.1951, leg. Prola», coll. Baldizzone.

— 1 ♂ (PG Bldz 5268) : «Anatolien, Kizilcahamam, 11.V.8.VI.1970, leg. Pinker», coll. Baldizzone.
— 1 ♂ (PG Bldz 9873) : «17.V.1969, Asia min. SO v. Maden (50 km SW v. Elazig) leg. Arenberger», coll. Baldizzone.
— 1 ♂ (PG Bldz 9879) : «20.V.1969, Asia min., Dünen 25 km SW v. Mersin, leg. Arenberger», coll. Arenberger.
— 1 ♂ (PG Bldz 7518) : «19.V.1969, Asia min., Taurus, 50 km N v. Tarsus, F. Kasy», coll. Naturhistorisches Museum Wien.

Diagnose : Envergure 14-15 mm. Tête (pl. I, fig. 2), thorax et abdomen d'un vert bronzé métallique. Palpes labiaux de couleur vert métallique uniforme : le deuxième article est à peu près 1 fois plus long que le troisième, et 1,5 fois que le diamètre de l'œil. Antennes, avec une grande touffe de poils à la base du premier article, entièrement de couleur vert métallique. Ailes antérieures uniformément vert bronzé métallique, avec des reflets de couleur cuivre à l'apex. Franges de la même couleur, mais plus matte et foncée. Ailes postérieures et franges de couleur d'un bronzé métallique foncé.

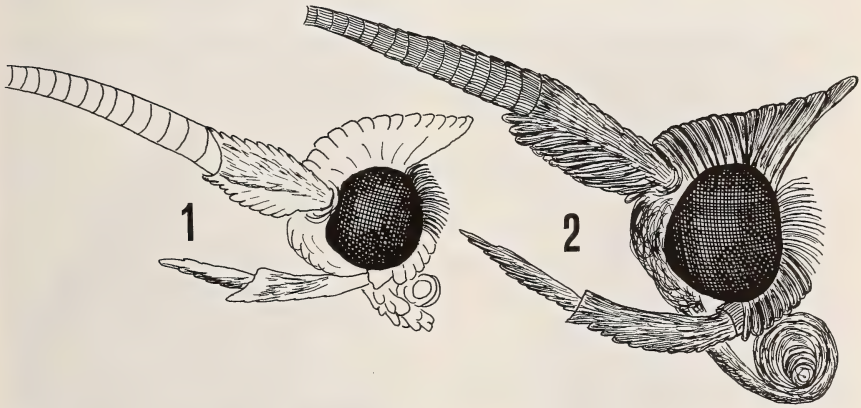

Fig. 1. *C. mediterranea* sp. n. : tête.
Fig. 2. *C. etrusca* sp. n. : tête.

Genitalia mâles (pl. II, fig. 3) : Gnathos globuleux. Tegumen petit, rétréci au milieu, avec deux longs bras aplatis. Transtilla petite, aplatie et arrondie. Valve étroite et allongée, un peu oblique, plus large à l'apex. Valvula large, hérissée de soies courtes, avec le bord ventral courbe, pourvue sur le bord dorsal d'une soie assez longue et courbe. Sacculus très simple : étroit et allongé, subtriangulaire, se terminant par une longue pointe triangulaire à l'angle dorso-caudal. Édéage conique,

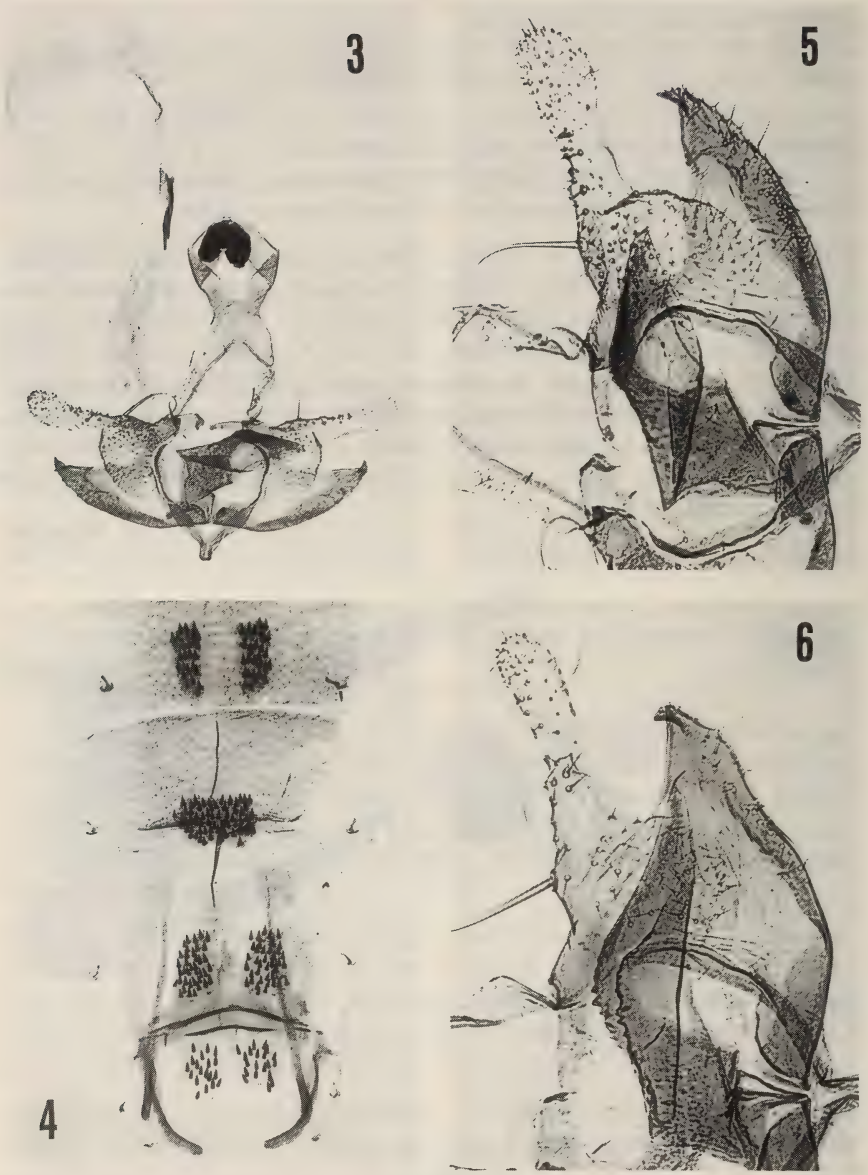

Fig. 3. *C. etrusca* sp. n. : genitalia mâles (PG Bldz 10215).
Fig. 4. idem : abdomen.
Fig. 5. idem : valve, sacculus et édéage grossis.
Fig. 6. idem : valve à un grossissement supérieur (PG Bldz 9873).

sclerifié sur le côté ventral et latéralement, présentant deux plis dorsaux faiblement dentelés dans sa partie proximale. Les cornuti (pl. III, fig. 7-10) 3-5 sont courts, de longueur différente, réunis dans une formation semblable à une épine dilatée à la base.

Structures de renforcement de l'abdomen (pl. II, fig. 4) : Pas de barres latéro-postérieures, la transversale est épaisse et courbe, avec le bord distal plus chitinisé. Les disques tergaux (3e tergite) sont à peu près 2,5 fois plus longs que larges.

Remarque : Cette espèce, dont la ♀ et la biologie sont inconnues, appartient au 13e groupe de Toll (1952) et doit être placée dans la section de *C. mayrella* (Hübner, [1813] (= *spissicornis* Haworth, 1828) à laquelle appartiennent également *C. hieronella* Zeller, 1849, *C. fuscoaenea*, Toll, 1952 et *C. fuscicornis* Zeller, 1847. Les différences les plus remarquables dans les genitalia mâles sont les suivantes : le tegumen d'*etrusca* est plus rétréci en son milieu ; la transtilla est plus grande et arrondie ; le sacculus est plus étroit et allongé et son bord latéral est droit et non courbe ; l'édéage est sclérifié seulement ventralement, tandis que celui de *mayrella* est complètement chitinisé et ne présente pas les séries de faibles dents dorsales d'*etrusca* ; les cornuti d'*etrusca* sont seulement au nombre de 3 à 5, tandis que ceux de *mayrella* sont nombreux et réunis en une longue formation.

Répartition géographique : Italie centrale et Anatolie.

C. mediterranea sp. n.

Holotype ♂ (PG Bldz 10289) : «Hispania, Dunes 8 km W Puente Umbria, Huelva, 19.VIII.1988, E. Traugott-Olsen leg.», coll. Baldizzone.

Paratypes : 1 ♀ (PG Bldz 10290) idem, coll. Baldizzone.
— 1 ♀ (PG Bldz 2749) : «Sicilia, Trapani, Marinella, 15.VIII.1978, leg. Triberti, coll. Baldizzone.
— 2 ♀♀ PG Bldz 10302) : «Italia, Prov. Oristano, Stagno di Cabras, 5.VIII.1983 Kuchlein leg. at light», coll. Baldizzone.
— 1 ♀ (PG Bldz 4128) : «Sardegna orient., La Caletta, 29.VII.1981-lux, leg. Baldizzone», coll. Baldizzone.
— 1 ♀ (PG Bldz 2475) ibidem, 2.VIII.1981 coll. Baldizzone.
— 1 ♀ (PG Kaltenbach 207) : «Sardinien, Prov. Nuoro, S. Lucia, 17.VII.1981» leg. et coll. Kaltenbach, Karlsruhe.
— 2 ♀♀ (PG Bldz 4133) : «Hispania, Cataluna, Salzgebiet/Rosas, 26.VII.1971» leg. coll. Arenberger et coll. Baldizzone.

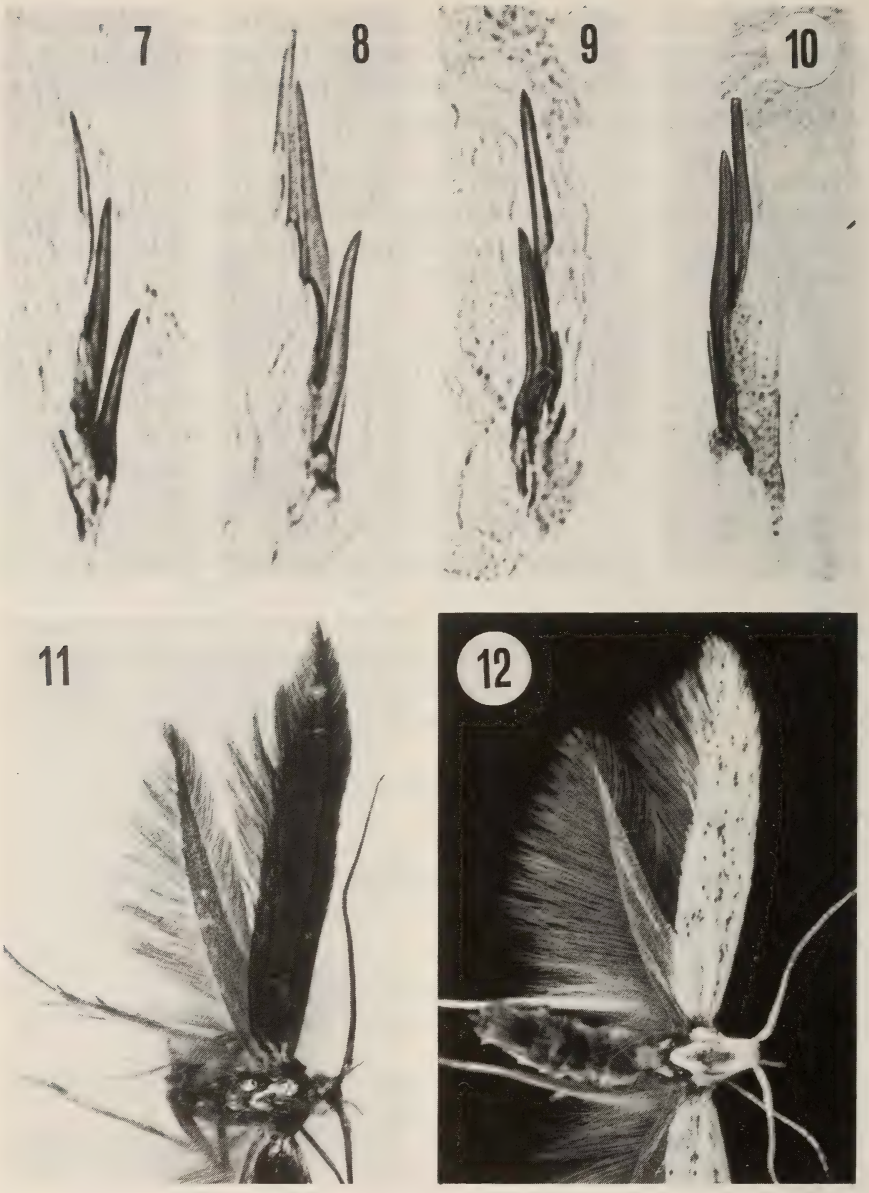

Fig. 7. *C. etrusca* sp. n. : cornuti très grossis (PG Bldz 5268).
Fig. 8. idem : même détail (PG Bldz 7335).
Fig. 9. idem : même détail (PG Bldz 9879).
Fig. 10. idem : même détail (PG Bldz 10215).
Fig. 11. idem : imago.
Fig. 12. *C. mediterranea* sp. n. : imago.

— 1 ♀ (PG Bldz 2475) : «Tunisie, Laghouat 14.VIII.1919, leg. Dumont» ex coll. Hartig, coll. Baldizzone.
— 1 ♀ (PG Bldz 2472) : «Tunisie, Sidi Maklouf, 30.VIII.1918, leg. Dumont» ex coll. Hartig, coll. Baldizzone.

Diagnose : Envergure 11-12 mm. Tête (pl. I, fig. 1) thorax et abdomen complètement blancs. Palpes labiaux blancs, avec quelques écailles brunes latéralement : le deuxième article est à peu près 0,5 fois plus long que le troisième et que le diamètre de l'œil. Antennes complètement blanches, sauf le premier article, qui est pourvu d'écailles ocre latéralement et d'un pinceau de poils blancs à la base. Ailes antérieures blanches, parsemées de quelques écailles brunes, plus nombreuses dans la région apicale ; franges blanches. Ailes postérieures d'un gris très clair un peu nacré.

Genitalia mâles (pl. IV, fig. 13) : Gnathos large et oval. Tegumen grand, rétréci en son milieu, avec deux bras très larges. Transtilla mince et linéaire, non divisée au milieu. Valvula chitinisée et hérissée de soies petites et minces : le bord dorsal est concave, tandis que le bord ventral est allongé en forme de goutte. Valve large et allongée, un peu plus dilatée à l'apex. Sacculus très sclérifié, avec le bord latéral concave, présentant une protuberance dans l'angle ventro-caudal se terminant par deux dents de longueur différente, et dans l'angle dorso-caudal une pointe émoussée avec 5 petites dents latérales. Édéage caractérisé par deux bandes sclérifiées très simples, aiguës à l'apex, l'une un peu plus longue que l'autre. La vesica est sclérifiée sur le côté ventral et renferme un cornutus très allongé en forme de clou dilaté à la base.

Structures de renforcement de l'abdomen (pl. IV, fig. 14) : Pas de barres latéro-postérieures, la transversale montre un bord proximal courbe et épais, et un bord distal plus mince et droit. Disques tergaux (3e tergite) hérissés d'épines très aiguës, à peu près deux fois plus longs que larges.

Genitalia femelles (pl. V, fig. 17) : Papilles anales très petites, et coniques, assez sclérifiées, couvertes de petites épines aiguës. Apophyses postérieures à peu près 2 fois plus longues que les antérieures. Lamella antevaginalis subtrapézoïdale avec le bord proximal convexe et le bord distal presque droit, hérissé de soies, fortement creusé en son milieu au niveau de l'ostium bursae. Lamella postvaginalis subtrapézoïdale, un peu plus petite que l'antevaginalis, présentant une protubérance conique au milieu du bord priximal. Ostium bursae ogival. Colliculum

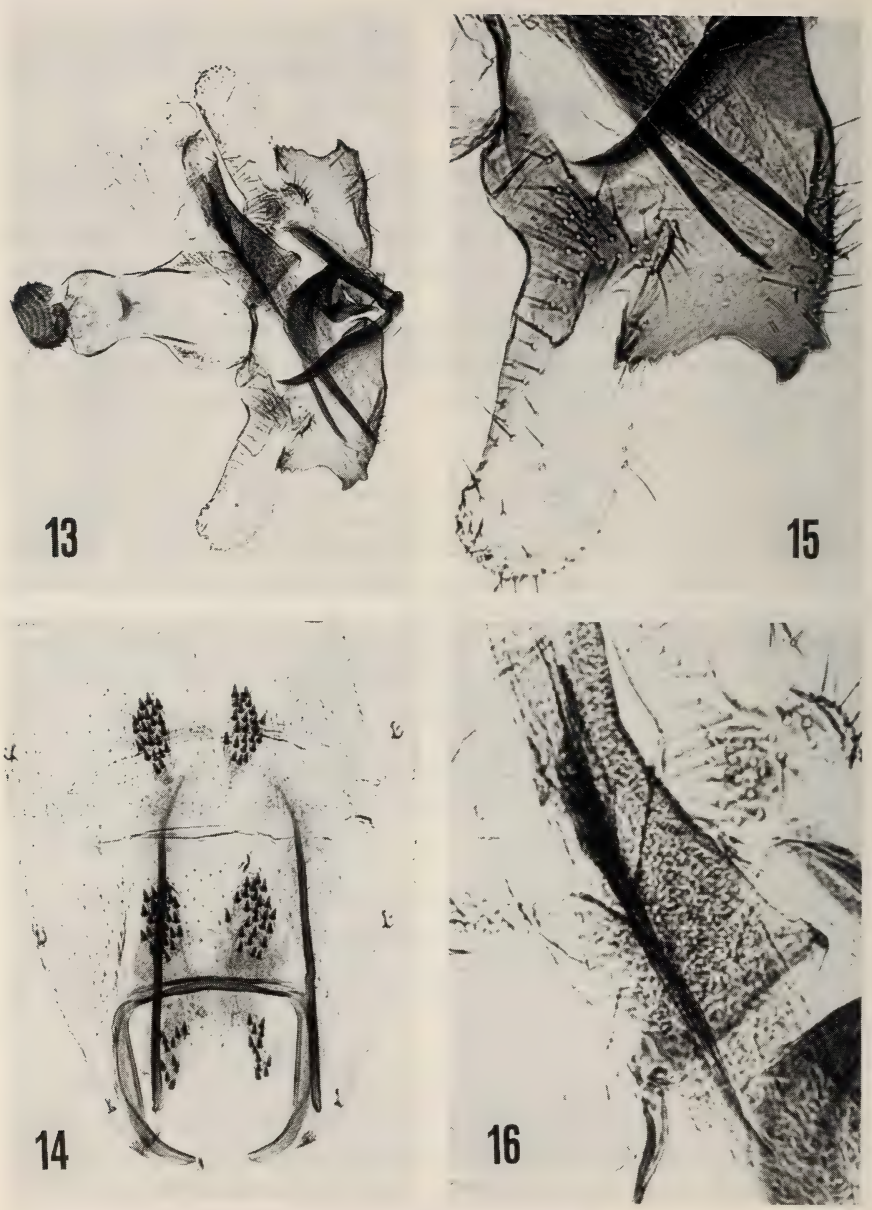

Fig. 13. *C. mediterranea* sp. n. : genitalia mâles.
Fig. 14. idem : abdomen.
Fig. 15. idem : valve, sacculus et édéage grossis.
Fig. 16. idem : cornuti très grossis.

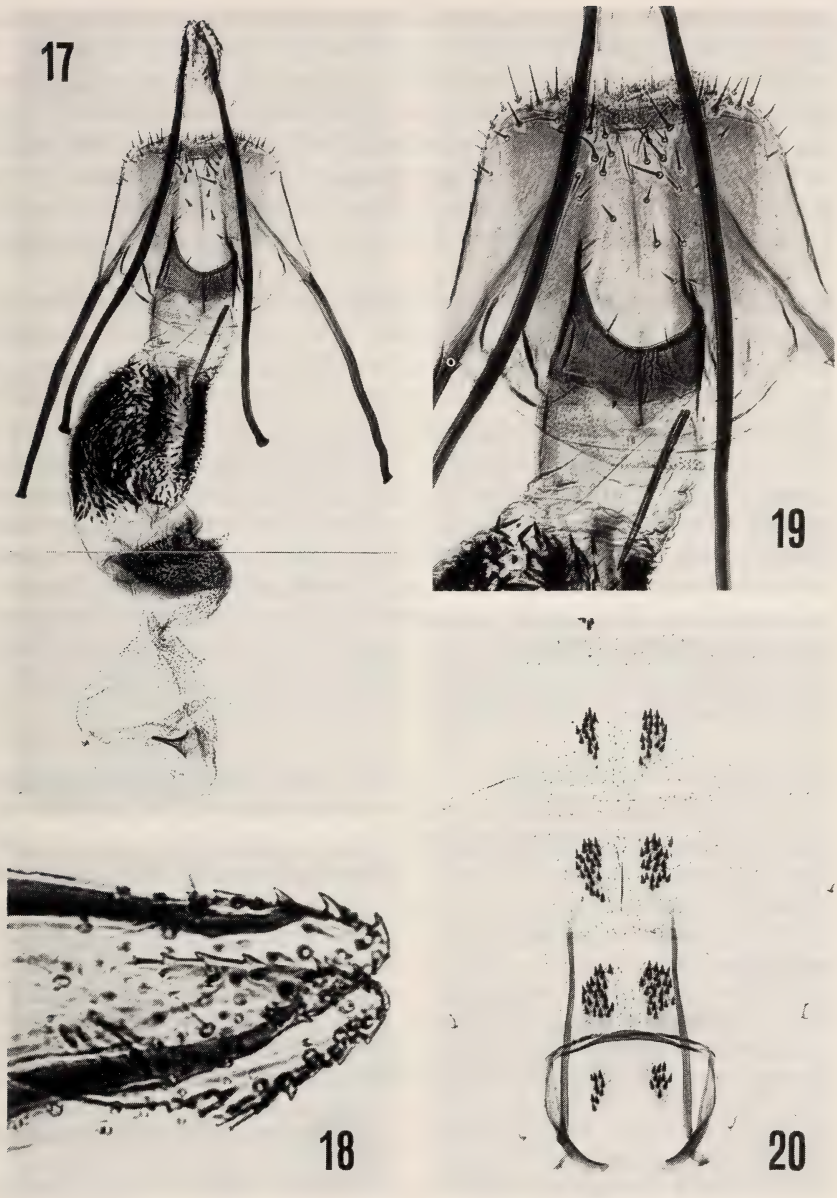

Fig. 17. *C. mediterranea* sp. : genitalia femelles (PG Bldz 10302).
Fig. 18. idem : papilles anales particulièrement grossies.
Fig. 19. idem : détail grossi.
Fig. 20. idem : abdomen.

en forme d'entonnoir, très sclérifié dans la moitié distale, et transparent dans la moitié proximale. Le ductus bursae est court et renflé ; il présente dans sa première partie deux bandes chitineuses symétriques, pourvues de petites épines coniques ; toute cette portion est enveloppée par un manchon d'épines longues et très aiguës. La seconde partie est presque transparente, sauf au niveau du ductus seminalis, où elle est couverte d'un grand nombre d'épines assez petites et émoussées. La bursa est ronde et pourvue d'un petit signum en forme de feuille.

Remarque : L'espèce, dont la biologie est inconnue, appartient au 30e groupe du système de Toll (1962), mais, en raison de la structure assez particulière des genitalia, il m'est difficile de la placer dans une section, auprès d'espèces déjà connues. Elle est presque certainement d'origine nord-africaine, et ressemble un peu à *C. afrosarda* Baldizzone & Kaltenbach, 1983 notamment par l'habitus (blanc, avec quelques écailles brunes) qui est caractéristique de la plupart des espèces des régions subdésertiques d'Afrique du Nord. En tout cas, les genitalia montrent des différences remarquables : chez le mâle de *mediterranea* les bras du tegumen sont plus courts ; la valve est plus longue et étroite ; le sacculus est plus massif et creusé sur le bord latéral ; l'édéage est dépourvu de dents à l'apex. Chez la femelle, les différences sont encore plus grandes, notamment la structure des lamelles ante- et postvaginalis et le ductus bursae.

Répartition géographique : D'après nos connaissances actuelles, l'espèce est répandue dans la région méditerranéenne occidentale, car elle a été recueillie en Tunisie, en Sicile, en Sardaigne et en Espagne, aussi bien sur la côte du Nord (Rosas) que sur la côte atlantique (Huelva).

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Chloridea ononis D. & S. : Evidence for an autochthonous population in the Swiss Alps (Lepidoptera, Noctuidae)

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Summary

Observations of imagines and larvae of *Chloridea ononis* D. & S. in the Swiss Central Alps (Tavetsch valley) over a period of twelve years (1977-1989) strongly suggest that an autochthonous population of this south-east European and Asian, migratory noctuid moth exists in the investigated area. In Central Europe, this breeding site is probably the northernmost reported so far and supports the assumption, that *Chloridea ononis* is also autochtonous in suitable habitats further north. Observations on oviposition and previously unrecorded larval host plants (*Sempervivum arachnoideum, Knautia arvensis, Dianthus silvester*) are also reported and discussed. It is suggested that the spectrum of larval host plant species changes during the larval development of *Chloridea ononis*.

Zusammenfassung

Beobachtungen von Imagines und Raupen von *Chloridea ononis* über einen Zeitraum von 12 Jahren legen nahe, dass diese südosteuropäisch-asiatische und als Wanderfalter bekannte Noctuide in den Schweizer Zentralalpen (Tavetsch) autochthon ist. Für Mitteleuropa ist dies vermutlich die nördlichste bisher bekannte autochthone Population. Diese Beobachtungen unterstützen die Vermutung, dass *Chloridea ononis* in geeigneten Habitaten weiter nördlich ebenfalls bodenständig ist. Beobachtungen über Eiablage und über bisher nicht bekannte Larvalfutterpflanzen (*Sempervivum arachnoideum, Knautia arvensis, Dianthus silvester*) werden ebenfalls mitgeteilt und diskutiert. Vermutlich ändert sich das Artenspektrum der Wirtspflanzen im Verlauf der Larvalentwicklung von *Chloridea ononis*.

Introduction

Chloridea ononis (Denis & Schiffermüller, 1775) is a noctuid moth which flies by day as well as by night (Forster & Wohlfahrt 1971, Koch 1984). Its distribution ranges from southern Europe eastwards

over South Russia and Central Asia to Southwest China (Spuler 1910, Seitz 1914, 1938). In Central Europe, it is only rarely found (Forster & Wohlfahrt 1971, Koch 1984). Forster & Wohlfahrt (1971) claim that there are no autochthonous populations of *Chloridea ononis* north of the southern border of the Alps, but Koch (1984) suggests that this species could also breed in suitable warm habitats further north. *Chloridea ononis* is a migratory species (Forster & Wohlfahrt 1971, Koch 1984) and specimens from Central Europe are mostly believed to be of migratory origin (Bergmann 1954). This paper reports the existence of a population of *Chloridea ononis* in the Swiss Central Alps (Tavetsch valley) which is most likely autochthonous and which is to my knowledge the northernmost in Central Europe reported so far. Observations on oviposition and previously unrecorded larval hosts are also reported and discussed in this paper.

Materials and Methods

The observations reported here were made in the Tavetsch valley in the Swiss Central Alps (46° 40' N ; 8° 44' E), at an altitude of 1600 m. Observations of imagines of *Chloridea ononis* were made during a field survey which was conducted during the whole growing seasons of the years 1977-1979 (Erhardt 1985a, b). After an interruption of observations from 1980-1982, caterpillars of *Chloridea ononis* were detected in 1983. From 1983-1989 the investigation was concentrated on searching for larvae (mid July-mid August). No special techniques were applied since larvae can easily be detected in the field when they are feeding on floral tissue.
Larvae were bred in 1983 and 1984 in the lowlands (city of Basel) and were kept under natural climatic conditions. Pupae overwintered and a total of 8 imagines hatched during the period April 30th to June 4th.
Field observations had again to be interrupted in 1985 and 1986 due to stays abroad.

Results and Discussion

1. *Geographical Distribution*

Imagines of *Chloridea ononis* were observed in all growing seasons from 1977-1979 (Table 1). The occurrence of the imagines on the same south-facing slopes during this observation period and the restriction of the observations to the hottest habitats in the valley suggested that the observed specimens had not migrated, but had completed their

life cycle in these habitats in the Tavetsch valley (Erhardt 1985a). This assumption was confirmed when I detected caterpillars of *Chloridea ononis* in 1983 at the same locality where I had observed the imagines four years ago. Caterpillars were since observed in all subsequent years (1983-1989) with the exception of 1985 and 1986 when observations were interrupted (Table 1).

These observations strongly suggest that an autochthonous population of *Chloridea ononis* exists in the Tavetsch valley. They contradict the statement of Forster & Wohlfahrt (1971) that *Chloridea ononis* is restricted in Central Europe to regions south of the Alps and support the assumption of Koch (1984) that there are also autochthonous populations of *Chloridea ononis* on suitable sites further north.

Table 1. Field observations.

Year	Observed Date	imagines number	Number of observed larvae	Host plant
1977	19.6.	1	—	—
1978	30.6.	1	—	—
	2.7.	1	—	—
1979	20.6.	2	—	—
	23.6.	1	—	—
	25.6.	2	—	—
	10.7.	1	—	—
1980-1982			observations interrupted	
1983	—	—	ca. 10	*Dianthus silvester*
1984	20.7.	1♀ ovipositing		*Knautia arv.* (2 eggs), *Semperv. arachn.* (1 egg)
			ca. 10	*Dianthus silv.*
			1	*Knautia arv.*
1985-1986			observations interrupted	
1987		—	4	*Dianthus silv.*
			1	*Knautia arv.*
1988		—	6	*Dianthus silv.*
1989		—	5	*Dianthus silv.*
Total 1977-1989		10	ca. 35	*Dianthus silv.*
			2	*Knautia arv.*

2. *Biology : Voltinism, oviposition and larval hosts*

Chloridea ononis is generally bivoltine (Bergmann 1954, Forster & Wohlfahrt 1971, Koch 1984). However, the observation dates

(table 1) and the fact that all bred pupae overwintered indicate that the observed population of *Chloridea ononis* is univoltine. This pattern fits well with other Lepidoptera species which occur over large geographical and/or altitudinal ranges and which are bivoltine under favourable climatic conditions, but become univoltine at the border of their geographical or altitudinal range.

On one occasion (20.7.1984), an ovipositing female was observed. This female oviposited on still unopened inflorescences of *Knautia arvensis* (L.) Coulter em. Duby and *Sempervivum arachnoideum* L., two larval foodplants not mentioned so far in the literature (Rebel 1910, Spuler 1910, Seitz 1914, 1938, Bergmann 1954, Forster & Wohlfahrt 1971, Koch 1984). Two eggs were laid at the base of two unopened florets in the same inflorescence of *Knautia arvensis* (Fig. 1), and one at the base of a flower bud in the inflorescence of *Sempervivum arachnoideum* (Fig. 2). In captivity, the young caterpillars readily accepted the young floral tissue of *Knautia arvensis* and *Sempervivum*

1

2

3

4

Fig. 1. Eggs of *Chloridea ononis* (arrows) on an unopened inflorescence of *Knautia arvensis*
Fig. 2. Egg of *Chloridea ononis* on an unopened inflorescence of *Sempervivum arachnoideum*.
Fig. 3. Larva of *Chloridea ononis* feeding on flower and seeds of *Dianthus silvester*.
Fig. 4. Adult larva of *Chloridea ononis* feeding in captivity on *Dianthus barbatus* L.

arachnoideum. However, most of the older larvae I observed in the field were feeding on flowers and seeds of *Dianthus silvester* Wulf., one of the dominating plant species at the site (Fig. 3, Table 1). This third larval foodplant has again not been reported so far in the literature. In captivity, the caterpillars also accepted flowers and seeds of other *Dianthus* spp., e.g. *Dianthus barbatus* L. (Fig. 4).

It is of interest that *Knautia arvensis* and *Sempervivum arachnoideum* were still in acceptable condition, i.e. in bloom, when most of the larvae of *Chloridea ononis* were found on *Dianthus silvester*. Also, the chances of finding caterpillars on *Knautia arvensis, Sempervivum arachnoideum* and *Dianthus silvester* appear to be similar for all three plant species, since larvae can easily be observed when they are feeding on the floral tissue of their host plants. If anything, larvae are more easily overlooked on *Dianthus silvester* than on the other two larval hosts, since they can hide in the calyx tubes of the flowers. It is also intriguing that the observed female was not seen to oviposit on *Dianthus silvester* although this plant species is distinctly more abundant at the study site than *Knautia arvensis* and *Sempervivum arachnoideum* and is used so frequently as host plant by the observed larvae. In addition, plants of *Dianthus silvester* had flower buds and open flowers and appeared to be in condition for oviposition when the ovipositing female was observed. An explanation of this apparently contradictory situation could be that females of *Chloridea ononis* have a specific oviposition behaviour and may oviposit only on dense and still unopened inflorescences not present in *Dianthus silvester* and that a shift in the larval foodplants from *Knautia arvensis, Sempervivum arachnoideum* and possibly also from other plant species with similarly structured inflorescences to plants with larger flowers such as *Dianthus silvester* takes place during the larval development of *Chloridea ononis*. However, more field observations are needed to prove this assumption.

The fact that none of the larval hosts in the Tavetsch valley is reported in the literature raises another point of interest. So far, *Ononis* spp., *Salvia pratensis* L., *Linum usitatissimum* L. and *Silene nutans* L. have been reported as larval hosts of *Chloridea ononis* (Spuler 1910, Rebel 1910, Seitz 1914, Bergmann 1954, Forster & Wohlfahrt 1971, Koch 1984). Except for *Silene nutans*, none of these plant species occurs at the site where *Chloridea ononis* was observed in the Tavetsch valley. *Ononis repens* L. and *Salvia pratensis*, although present in the Tavetsch valley, are not abundant and *Linum usitatissimum* is completely absent. Although *Silene nutans* is present at the observation site, I have not yet observed caterpillars feeding on it. This could be

due to the fact that *Dianthus silvester* is much more abundant than *Silene nutans* at the investigated site. Accepting *Dianthus silvester* as a substitute for *Silene nutans* does not seem to be too difficult for the caterpillars of *Chloridea ononis*, since both of these plant species belong to closely related genera in the same subfamily (Silenoideae) of the Caryophyllaceae. Given these conditions, it could well be that the spectrum of larval food plants changes at the border of the geographical range of *Chloridea ononis*. Another explanation for the reported observations could simply be that the spectrum of larval hosts of *Chloridea ononis* is generally larger than so far reported.

This example shows also how limited our knowledge on the life cycle of many of our moths still is.

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Zur Verbreitung von *Scopula vigilata* (Prout) in Europa (Lepidoptera, Geometridae)

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Summary

Scopula vigilata (Prout, 1913) is a little known species previously recorded only from central and southern Italy, but recent observations from Greece (Peloponnes) and Yugoslavia (Dalmatia) show a wider distribution. *S. vigilata* can be very easily confused with similar species.

Scopula vigilata (Prout, 1913) war bisher nur aus Italien, Mittelitalien südwärts bis Sizilien bekannt. Beobachtungen in neuerer Zeit aus Jugoslawien und Griechenland weisen auf eine weitere Verbreitung der Art im Mittelmeerraum hin : Jugoslawien : Dalmatien, Insel Solta (nahe Split), 13.-28.9.1989 (Schaub) 14 ♂♂, 1♀. Griechenland : Peloponnes, Argolis, 8.-17.6.1980 (Kohonen) 3 ♀♀.

Die beobachteten Flugzeiten lassen auf mindestens zwei Generationen im Jahr schliessen. Da die Art lokal offenbar nicht selten ist, liegt der Verdacht nahe, dass sie bisher mit ähnlichen, weiter verbreiteten Arten verwechselt wurde, z.B. mit hellen und kleineren Exemplaren der *S. marginepunctata* (Goeze) und solchen der *S. submutata* (Tr.), oder Arten aus der Gattung *Idaea*. Um eine sichere Determination zu ermöglichen, habe ich die männlichen und weiblichen Genitalarmaturen abgebildet.

Den Herren Matti Ahola (Koski Hl/Finnland) und Willibald Schmitz (Berg. Gladbach/BRD) danke ich für das mir zugesandte Untersuchungsmaterial.

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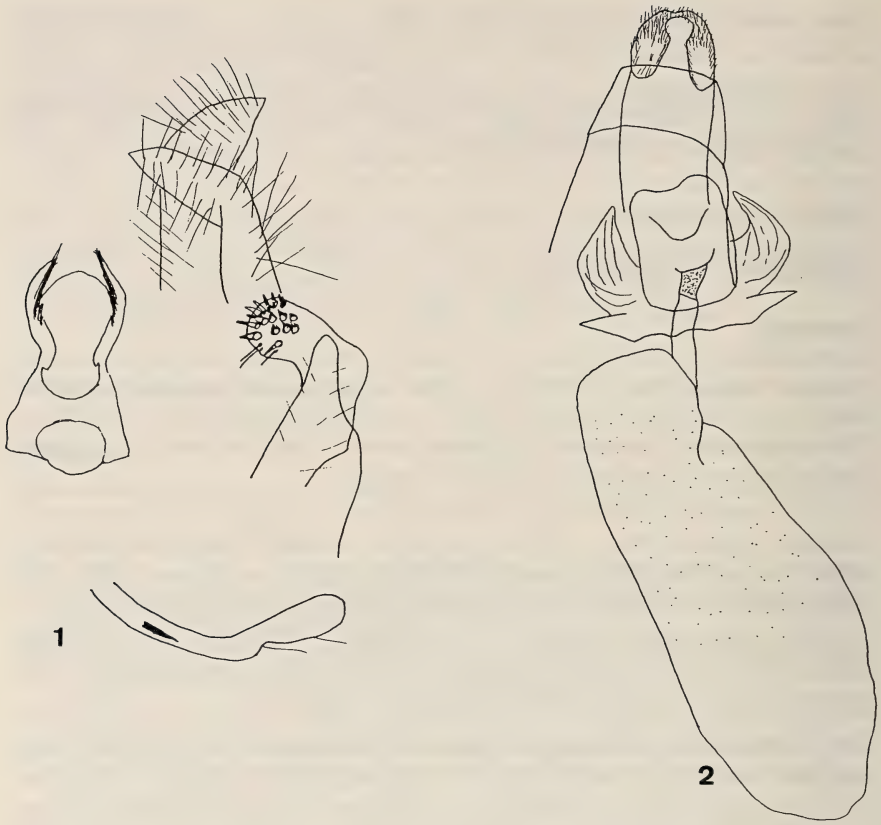

Abb. 1. Die männlichen Genitalien von *S. vigilata* (Prout). Oben : Uncus ; links : Ventralplatte des 8. Hinterleibssegmentes ; rechts : Valve und Sacculus ; unten : Aedoeagus.
Abb. 2. Die weiblichen Genitalien von *S. vigilata* (Prout).

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Description de trois espèces nouvelles de la région himalayenne (Lép. Noct. Hadeninae et Cuculliinae)

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Summary

Three new species of Noctuidae occuring in Northern India are here described : *Melanchra diabolica* sp. n. (Hadeninae), from India, Kashmir, whose male genitalia reveal a noticeable relationship with the american species *M. picta* Harr. ; *Dryobotodes aulombardi* sp. n. (Cuculliinae) from north Pakistan and India, Kashmir, and *Trichoridia warreni* sp. n. (Cuculliinae) which is the species figured by Warren (in Seitz, vol. XI) as the female of *T. canosparsa* Hmps.

HADENINAE

Melanchra diabolica sp. n.

Holotype ♂ : Inde, Cachemire, Lihenwan, env. de Naubug, 2.850 m, 21-VI-1976 (J. Plante leg.) (ma coll.)

Paratypes : 3 ♀♀ idem ; 2 ♀♀ Inde, Cachemire, Sonamarg, 2.500 m env., 7/8-VII-1982 (J. Plante leg.) ; 1 ♀ Népal, Langtang, Kyangjin Gompa, 3.900 m env., 3/5-VI-1976 (J. Plante leg.) (ma coll.)

♂ (fig. 1) : Env. 42 mm. Tête, thorax, abdomen et pattes d'une teinte variant, selon les exemplaires, du brun rosé au brun-gris légèrement violacé. Front et collier barrés transversalement d'une ligne sombre, comme chez la plupart des espèces de *Mamestra* sensu lat. Touffe anala orangée. Fond des ailes antérieures concolore au thorax. Antémédiane bien visible, double. Postmédiane moins marquée. Petit trait foncé le long de la nervure 2, entre les lignes médianes. Orbiculaire et réniforme larges, bien dessinées, comme chez *Lacanobia w-latinum* (Hufnagel), mais sans trace de blanc. L'espace subterminal est également moins large, et n'a ni la netteté, ni l'éclaircie bleuâtre que l'on voit chez cette dernière. Trait basal présent. Lignes transverses, notamment la subterminale, ni jaunâtres ni blanchâtres mais concolores au fond de l'aile. Ailes postérieures à bords légèrement crénelés et à frange blanche. Extrémité des tarses blanchâtre. Antennes à ciliation d'une longueur voisine du diamètre de l'antenne.

1 2

3 4

5 6

Pl. 1. *Melanchra diabolica* sp. n., holotype ♂.
Pl. 2. *Melanchra diabolica* sp. n., paratype ♀, Inde, Cachemire, Lihenwan.
Pl. 3. *Dryobotodes aulombardi* sp. n., holotype ♂.
Pl. 4. *Dryobotodes aulombardi* sp. n., allotype ♀.
Pl. 5. *Trichoridia warreni* sp. n., holotype ♂.
Pl. 6. *Trichoridia warreni* sp. n., allotype ♀.

Dessous des quatre ailes de même teinte que le dessus, sans parties claires. Postmédiane et point discoidal apparents.

♀ (fig. 2) : Env. 36-38 mm. Identique au mâle, les antennes à ciliation beaucoup plus courte.

Armature génitale ♂ (fig. 7) : De même type que *M. pisi* (L.). mais surtout que de l'espèce américaine *M. picta* (Harrison) (fig. 8) (= *exusta* Guenée), l'armature de la nouvelle espèce présente un processus costal plus long que chez ses congénères, recourbé, et se terminant par une petite boule, tandis que l'extrémité apicale de la valve s'allonge de façon remarquable en un long digitus, comme une corne, ce qui confère à l'armature l'aspect d'une tête de diable.

Franclemont et Todd (in Hodges, 1983) ayant fait de *Ceramica* Guenée (espèce-type : *persicariae* L.) un synonyme de *Melanchra*

Hübner (espèce-type : *exusta* Guenée), c'est dans ce dernier genre qu'il convient de placer la nouvelle espèce.

Il est tout-à-fait surprenant de constater, dans les genitalia, une telle parenté entre deux espèces, l'une américaine et l'autre du versant sud du massif himalayen.

CUCULLIINAE

Dryobotodes aulombardi sp. n.

Holotype ♂ : Pakistan, Baltistan, Shigar, 32 km au nord de Skardu, alt. 2.190 m, 17/18-X-1989, (Aulombard et Plante leg.) (ma coll.)

Allotype ♀ : Inde, Cachemire, Sonamarg, alt. 2.500 m, 5/6-X-1977, (J. Plante leg.) (ma coll.)

Paratypes : 4 ♂♂ et 4 ♀♀ idem (ma coll.)

♂ (fig. 3) : Env. 30/32 mm. Aspect général assez voisin des autres espèces de ce genre, notamment de *D. monochroma* Esper. S'en distingue toutefois sensiblement, notamment par la taille plus réduite, les ailes antérieures plus aiguës à l'apex, la teinte gris-jaune, les ailes postérieures plus claires et brillantes. Orbiculaire ovale, assez diffuse, à peine plus claire que le fond de l'aile. Réniforme en revanche très claire, grande, ovale et oblique. L'espace terminal est également plus étroit chez la nouvelle espèce que chez *D. monochroma*, et il n'y a pas de tache claire bien marquée à la hauteur de la nervure 2. En outre, le trait foncé caractéristique qui, chez beaucoup d'espèces de ce genre, unit, à la hauteur de cette même nervure 2, les lignes anté- et postmédiane, est présent, mais assez diffus. L'antemédiane, la postmédiane et la subterminale, sont bien visibles et formées d'un trait clair externe et d'une ligne foncée interne. Antennes finement dentées, à dents triangulaires d'une longueur atteignant la moitié du diamètre de l'antenne et coiffées d'un plumet de cils clairs nettement plus long.

Ailes postérieures de même teinte que les antérieures, à bord également légèrement crénelé, où sont également bien visibles les deux traits formant la postmédiane et la subterminale, surtout le clair.

Le revers des quatre ailes est à peu près semblable, comme teinte, au dessus, la réniforme se détachant en clair ainsi que l'espace terminal. Postmédiane visible mais peu accentuée. Point discoidal au contraire bien marqué en forme de petite tache ronde.

♀ (fig. 4) : Env. 29/35 mm. Identique au mâle, contrairement aux femelles de *monochroma* qui sont toujours sensiblement plus sombres que les mâles. Antennes filiformes.

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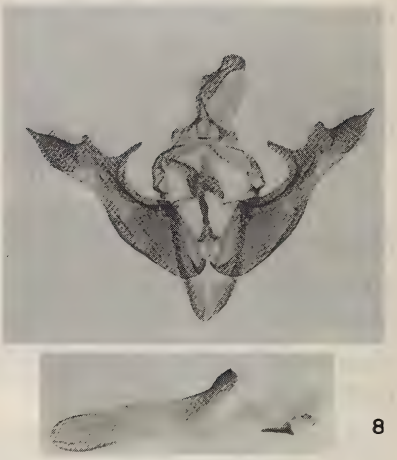

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Pl. 7. *Melanchra diabolica* sp. n., holotype, prép. PL 355.
Pl. 8. *Melanchra picta* Harr., USA, Arizona, prép. BM (NH) Noct. 4712.
Pl. 9. *Dryobotodes aulombardi* sp. n., paratype (Inde, Cachemire, Sonamarg) prép. PL 462.
Pl. 10. *Trichoridia warreni* sp. n., paratype, prép. PL 1042.

Armature génitale ♂ (fig. 9) : Valves allongées, encore plus étroites que chez *D. roboris* Boisduval. Cucullus dépourvu de corona. Uncus épais, lancéolé, un peu comme chez *D. banghaasi* Draeser. Pas de processus costal. Clasper robuste et légèrement spatulé. Fultura inférieure en forme d'écusson, se terminant en pointe à sa partie inférieure, et surmontée d'une sorte de bouton hérissé de fines épines. Peniculi longs, recourbés vers l'intérieur et spatulés. Deux cornuti à la partie distale de la vesica, et un amas de spicules en son centre.

Cette espèce est amicalement dédiée au Dr François Aulombard, de Carentan (Manche), compagnon fidèle de mes chasses entomologiques.

Trichoridia warreni sp. n.

Holotype ♂ : Inde, West Bengal, Tiger Hill, alt. 2.573 m, 30-IX/5-X-1986 (Aulombard et Plante leg.) (ma coll.)

Allotype ♀ : idem (ma coll.)

Paratypes : 7 ♂♂ idem ; 1 ♂ et 6 ♀♀ West Bengal, Kurseong Forest, alt. 420 m, 7-X-1986 (Aulombard et Plante leg.) (ma coll.)

Dans le volume XI des Macrolépidoptères du Globe, de A. Seitz, Warren fait figurer, planche 14 g,. le mâle de *Trichoridia canosparsa* Hampson, et, à côté de lui, ce qu'il présente comme en étant la femelle, bien différente du mâle. Or, Hampson, (1894, p. 232) dans la description originale de cette espèce ne parle pas de la femelle et n'en fait pas davantage mention dans son Catalogue des Noctuidae du British Museum (vol. VI, 1906, p. 404).

J'ai pris en 1983 au Langtang, Nepal, une trentaine d'exemplaires de cette espèce, tous mâles. En 1986, en revanche, au cours de deux chasses effectuées en compagnie du Dr Aulombard dans la région de Darjeeling, nous avons capturé une dizaine de specimens en tous points conformes à la femelle figurée par Warren. Ma surprise fut donc grande de constater que cette dernière récolte comprenait autant de mâles que de femelles. Il apparaissait ainsi que Warren s'était mépris en désignant comme la femelle de *T. canosparsa* une noctuelle appartenant, en réalité, à une espèce totalement différente, d'habitus comme de genitalia, demeurée à ce jour non nommée, et dont voici la description :

♂ (fig. 5) : Env. 33/37 mm. Teinte générale gris-noir. Tête, thorax, palpes et fémurs gris-noir mêlé de poils blancs. Abdomen et ailes postérieures plus clairs, sauf les crêtes des premiers segments abdominaux. Tarses et tibias annelés de noir et de blanc. Orbiculaire et réniforme légèrement plus claires que le fond de l'aile, leur contour

marqué de petits points blancs. Pas de trait basal ni de claviforme. Lignes antémédiane et postmédiane faiblement marquées, ombre médiane réduite à un trait en zigzag, ces trois lignes n'étant vraiment nettes qu'à proximité du bord interne. Ligne terminale constituée d'une succession de petites taches noires assez diffuses et de petits points blancs au contraire bien visibles, surtout au tornus où trois d'entre eux, disposés en triangle, constituent un signe distinctif bien particulier. Antennes formées d'articles à section triangulaire dont chacun porte un faisceau de cils clairs d'une longueur à peu près égale au diamètre de l'antenne. Aux ailes postérieures, la postmédiane est peu marquée, et il n'y a pas de point discoidal visible.

Revers des quatre ailes d'un gris-noir uniforme, plus clair que le dessus, avec une éclaircie le long du bord interne. Seule, la postmédiane est bien visible aux postérieures.

♀ (fig. 6) : Env. 34/36 mm. Identique au mâle, les cils des antennes beaucoup plus courts.

Armature génitale ♂ (fig. 10) : Valves larges à la base, plus étroites dans la partie médiane, et se terminant par un cucullus bien individualisé, de forme triangulaire, aigu à son extrémité interne, et portant un éperon à l'angle externe. Clasper robuste, en forme de pouce. Corona formée de cils courts parallèles, régulièrement disposés, et renflés à leur base. Uncus mince, effilé, non spatulé. Dans la vesica, deux amas de cornuti au centre, entourés de fins spicules, et un autre agrégat de spicules à la partie distale.

Une telle armature s'écarte, par sa configuration bien particulière, de celle de *canosparsa*, mais aussi de celles des autres espèces actuellement rangées dans le genre *Trichoridia*, et plus particulièrement de l'espèce-type *T. herchatra* Swinhoe. On peut en conclure qu'une révision de ce genre et des genres voisins serait souhaitable, et qu'il en résulterait probablement de nombreux changements dans la répartition générique des espèces en cause.

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Morphology of the intromittent organ and distal male genital duct in Coleophoridae (Lepidoptera, Gelechioidea)

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Summary

A phallotheca type intromittent organ is described from the Coleophoridae. Supposed autapomorphies of the family are listed and a list of morphological terms is added.

Introduction

The coleophorid intromittent organ may be called a phallus of the phallotheca type as proposed by Snodgrass (1935). This term was also used by Matsuda (1976) and Kristensen & Nielsen (1979). The enlarged and distally extending phallobase forms a tube surrounding the aedeagus, named the phallotheca. The cited authors consider, that the anterior portion of the phallotheca is double-walled and consists of a wall or phallocrypt, and the phallotheca proper (illustrated by Kristensen (1984b) in the Agatiphagidae). They also use the term endotheca for the inner wall of the former. This interpretation is followed in the present paper. The phallotheca type of phallus is known in some other groups of insects (e.g. Trichoptera), and in the Lepidoptera has been noted in the Agatiphagidae (Kristensen, 1984b) and Heterobathmiidae (Kristensen & Nielsen, 1979). The formation in the Eriocraniidae, which was called the "duplicature ... of the ventral wall of the genital chamber" (Birket, Smith & Kristensen, 1974) has also been interpreted as a phallotheca by Kristensen (1984b). Now, for the first time, a phallotheca has been discovered in ditrysian Lepidoptera.

In the Coleophoridae the structure of the phallus is peculiar, but has never been correctly interpreted. All authors used the term aedeagus for the phallotheca (cf p. 227). Only Kuznetsov & Stekolnikov (1978) attempted to explain a process for the formation of the aedeagus, but also incorrectly.

Material and methods

The morphology of the male genitalia of *Coleophora* was studied in several Central European species, but mainly *C. lixella* ZELLER, 1849, using material treated with potassium hydroxide. Histological sections were prepared from two *Coleophora* species.

Results and discussion

The phallus is situated in a slightly asymmetrical genital chamber, limited by the thin wall of the phallocrypt (Fig. 5). It is almost entirely composed of a delicate cuticle and only its lateral and ventro-lateral parts are, in the basal area, sclerotized (Figs. 1, 2). These sclerotized walls extend ventrally and distally into a V-shaped plate forming a variably developed double-walled structure, the caulis. The distal part of this sclerite attaches to the bases of the sacculi, and has small lateral emarginations or lobes which are enlarged dorsally. The edge of the fusion of the ventro-lateral walls runs for some distance along the phallotheca, forming a narrow ventral part of the genital chamber. The space formed terminates near the top of the coecum-like prominence of the base of the phallus (Figs 1, 2). The composite wall formed by the fused phallocrypt and phallotheca observed by KRISTENSEN & NIELSEN (1979), is here extremely small, or completely atrophied, especially in the dorsal part of the organ.

The *phallotheca* (Figs 1, 2, 5) is in all species a well developed sheath around the aedeagus, more or less distinctly extending beyond the apex of the latter. In primitive species the sclerotization of the phallotheca is almost uniform or gradually merges into the membranous areas. In the more developed species there appears a secondary membranisation and the sclerotized parts may form various specialised processes or lobes.

The *endotheca* (Figs 1, 5) is a thin-walled membranous sheath very close to the phallotheca. It extends proximally through the anterior opening of the latter, forming at its border a more or less distinct and complete collar-like prominence. More anteriorly the wall of the endotheca develops a more or less distinct ring-shaped sclerite (Fig. 1) ; in systematic papers this is called the annulus. KRISTENSEN (1984a) illustrates a similar structure in *Epimartyria*. In *Coleophora* there is, however, no inner wall of the phallobase, as the aedeagus is completely membranous. The wall of the aedeagus is continuous with the endotheca just in front of the sclerite and it extends proximally as the outer tube.

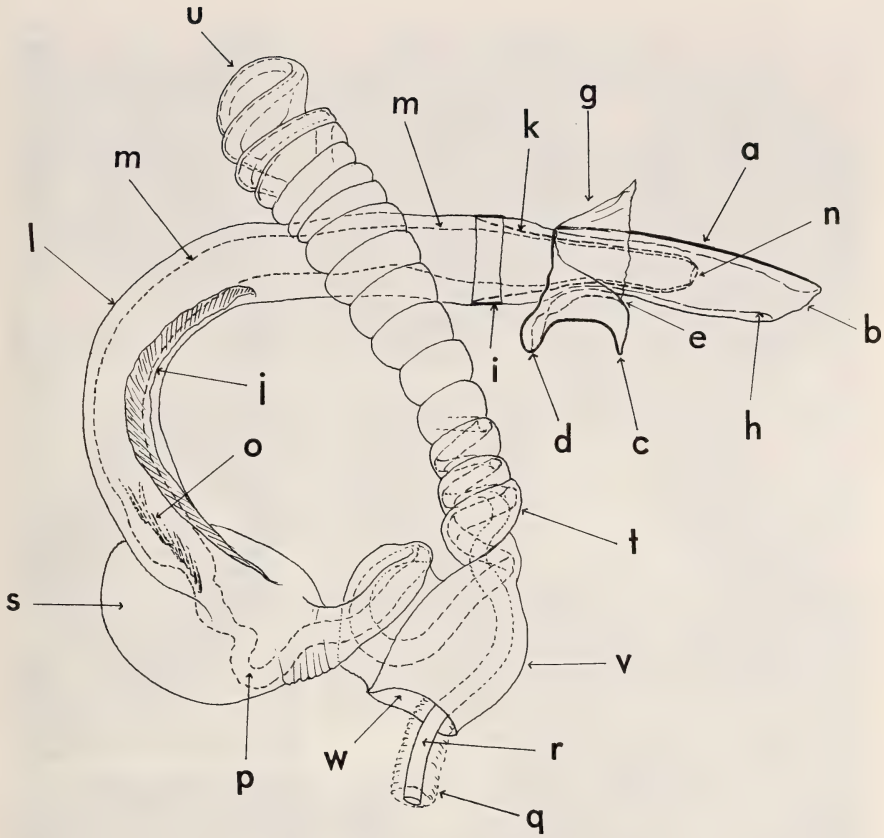
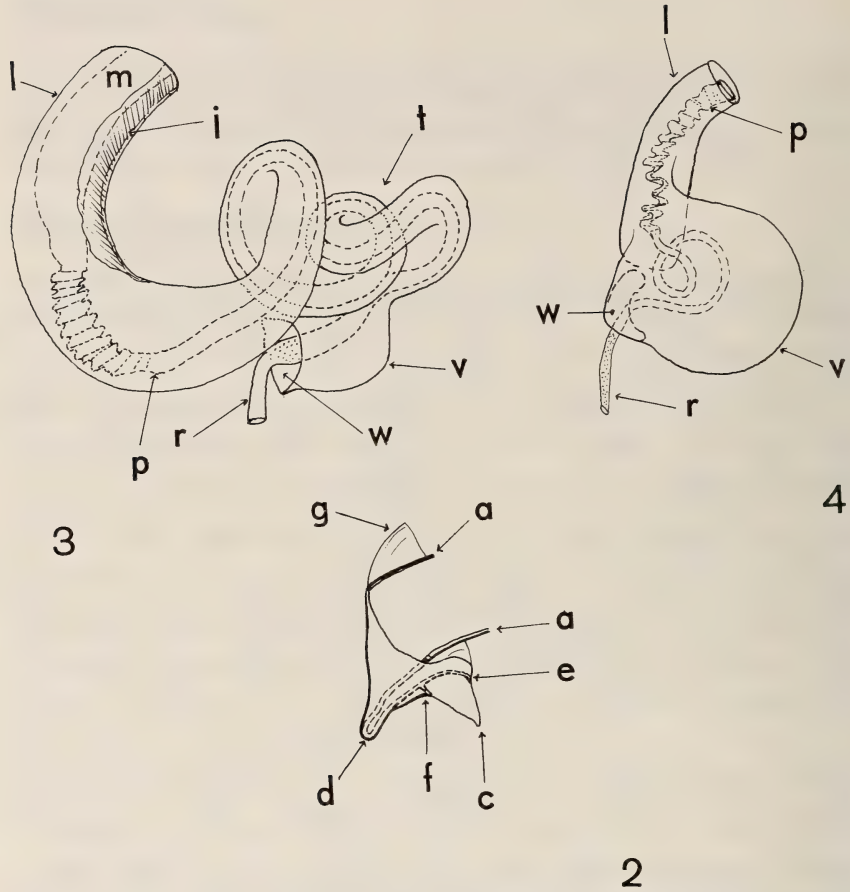


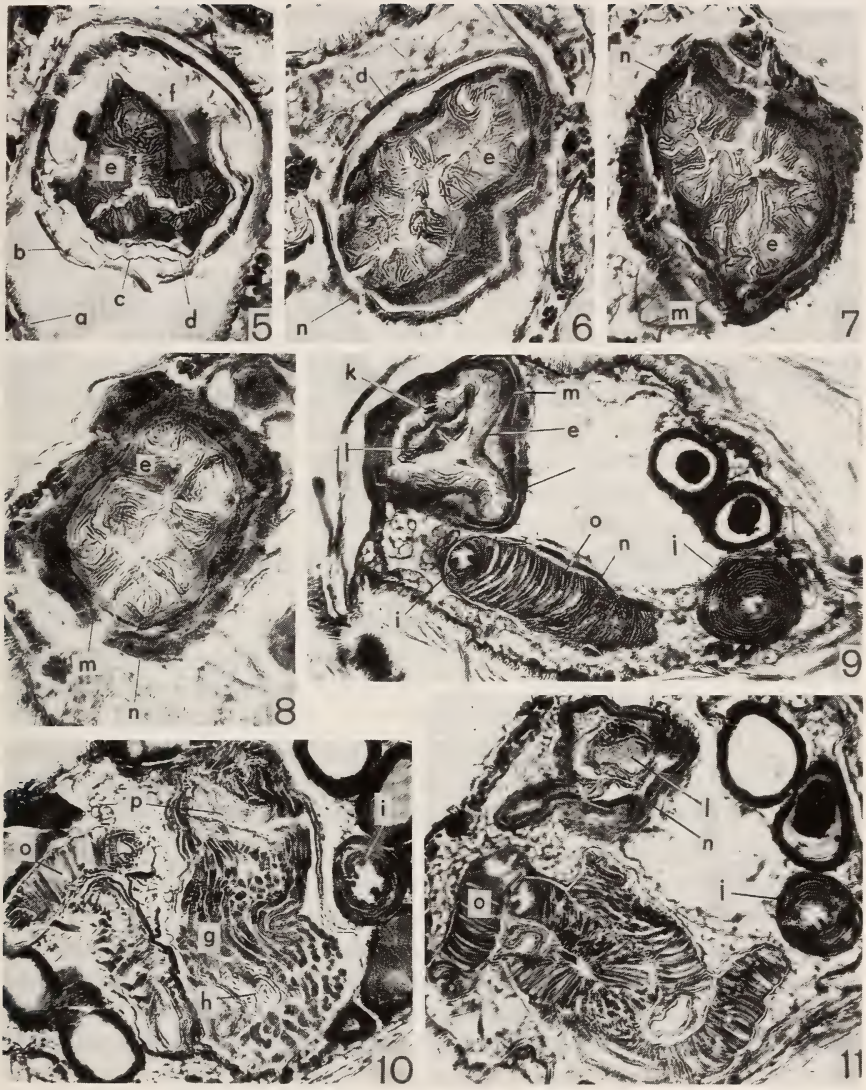
Fig. 1. Lateral view of intromittent organ and posterior parts of genital duct of *Coleophora lixella* Zeller ; a — phallotheca, b — distal opening of phallotheca, c — caulis, d — apex of pseudocoecum, e — border of fusion of walls of caulis, f — inner rib of caulis, g — wall of phallocrypt, h — endotheca, i — annulus, j — longitudinal sclerite of outer tube, k — aedeagus, l — outer tube, m — endophallus (vesica), n — secondary gonophore, o — cornuti, p — ductus ejaculatorius simplex, q — circular muscles, r — proximal part of ductus ejaculatorius simplex, s — sac of outer sheath, t — appendix, u — apical loop of appendix, v — proximal part of outer sheath, w — opening of outer sheath.

The *aedeagus* (Figs 1, 5, 6) is a thin-walled membranous tube originating at the anterior margin of the annulus (if that is present) and extending distally usually to beyond mid-length of the phallotheca. At the apex of aedeagus there is a slightly asymmetrical secondary gonophore. The distal portion of the aedeagus may slightly protrude as its wall is delicately plicate, at least in some species.



Figs 2-4. 2. Basal portion of phallus of *Coleophora lixella* Zeller, 3. Medio-proximal parts of outer sheath and ductus ejaculatorius of *Augasma aeratella* (Zeller), 4. The same, *C. spiraeella* Rebel. For abbreviations, see Fig. 1.

The *endophallus* (Figs 1, 5-9, 11) is an extremely long, densely plicate membranous tube. Inside the aedeagus there are long epidermal thickenings between the endophallus inside the aedeagus. The shape of the endophallus changes, as seen in the cross-sections (Figs 4-6). When the plication is completely extended, the length of the endophallus increases up to 7 times. In many species the cornuti are situated in the most proximal part of the endophallus. Anteriorly to them there is a weak constriction of the duct which I believe is the beginning of the endophallus.



Figs 5-11. Transverse sections : 5. At mid-length of phallotheca ; 6. At base of aedeagus ; 7. Near mid-length of outer tube ; 8. Posterior to sac ; 9. Just beyond sac ; 10. Through sac ; 11. Through end part of tube and appendix ; a — wall of phallocrypt, b — phallotheca, c — endotheca, d — aedeagus, e — endophallus, f — anchorage of endophallus inside aedeagus, g — muscles of sac, h — tracheae, i — proximal, endodermal part of ductus ejaculatorius, j — circular muscles, k — cornuti, l — spermatophore, m — muscles of endophallus, n — outer sheath, o — transverse muscles, p — median part of ductus ejaculatorius.

Outer sheath. This term is used provisionally ; at least in coleophorid systematics it is useful. It concerns the entire ectodermal membranous structure anterior to the phallus. Anatomically it is most probably an apodemal structure formed by a complete fusion of extensions of the endothecal and aedeagal walls. In the literature I could not find any special term for this structure. Moreover, in almost all taxonomic papers the most posterior, tubular part of it is incorrectly named the ductus ejaculatorius. Callahan & Chapin (1960) and Callahan & Cascio (1963) call it a cuticular or outer tube of the ductus ejaculatorius simplex (in the Nearctic noctuid moth *Heliothis zea*) and Căpuşe (1971) calls it the "canal glandulaire" of the ductus ejaculatorius of Coleophoridae. In the latter family the outer sheath is much more complex than in other Lepidoptera examined and consists of several parts (Figs 1, 3, 4). The most posterior of these is a long, usually bent funnel called here the tube (outer tube of Callahan & Cascio). It runs medially, then dorsally in the abdomen, then more anteriorly bends downwards and distad from where the sheath broadens and coils in various ways. The inner curvature of the arch is usually strengthened by an elongate sclerite which terminates in the dorsal wall of a broadening of the sheath often developed in the form of a sac. The anterior part of the tube is more or less coiled, usually broad, especially in the most proximal portion, and terminates in a broad anterior opening. In several species a densely coiled appendix is found in the terminal portion, directed proximally, terminating in an apical loop. The shape of the tube changes to some degree, as seen in transverse sections (Figs 7-9, 11). Several tracheal branches enter through the proximal opening, some of them eventually penetrating the sac (Fig. 10).

The *ductus ejaculatorius* (Figs 1-11) is partially discussed under endophallus. Anteriorly to the endophallus, in a sac or broadening of the outer sheath, it is more or less distinctly folded and embraced by strong striated muscles (Fig. 10) ; subsequently it runs inside the coiled part or appendix, situated laterally in the latter and accompanied by several layers of transverse muscles. The proximal portion of the ductus ejaculatorius simplex is lined with a very thin intima and surrounded with strong, circular striated muscles (Figs 9-11).

Conclusions

As in some other lepidopterous families, the phallus of the Coleophoridae is of the so called phallotheca type, but differs from these other families in several characters. It is therefore considered to have evolved independently and may be treated as an autapomorphy, since this type

of phallus appears to be distributed throughout the family (over 100 species examined). The structure of the phallotheca is subject to strong variation within the family, being simple in more primitive species and specialised, with sharply differentiated sclerites, in more advanced species. However, it is suggested that the process of specialisation of the sclerites occurred independently in the coleophorids several times.

Further possible autapomorphies of the examined structures are as follows : presence of a tubular, membranous aedeagus ; complete atrophy of the coecum penis ; development of a false coecum penis ; structure of the caulis and median plate ; presence of a ring-shaped sclerite (annulus) ; very long tube of the outer sheath ; a very long densely plicate endophallus ; presence of a longitudinal sclerite of the tube ; development of a long, coiled appendix. Some of these characters are secondarily reduced in various species.

List of terms used in taxonomic papers

Aedeagus. Almost all authors use this term for the phallotheca or entire phallus.
Anellus. Căpuşe (anelius) called this the median sclerite and caulis ; Toll, the caulis.
Annulus. Ring-shaped sclerite in endotheca anterior to the phallus.
Appendix (of outer sheath). Coiled part of outer sheath.
Boulbe ejaculateur. Term used by Căpuşe for broadening of outer sheath called here 'sac of the outer sheath'.
Cornutus. Correctly termed in all papers.
Ductus ejaculatorius (excl. its distal part, the vesica). In Căpuşe's terminology it comprises the "canal-non-glandulaire", "boulbe ejaculateur" and "canal glandulaire", of which the first corresponds to the real ductus ejaculatorius simplex, the two others with the outer sheath.
Lamina ductus. Longitudinal sclerite of the tube of the outer sheath, applied by Căpuşe to the ductus ejaculatorius.
Outer sheath. Toll used the term vesica, Căpuşe the canal glandulaire (of ductus ejaculatorius).
Phallotheca. Căpuşe named it the aedeagus or penis, Toll the aedeagus.
Phallus. In Coleophoridae of the phallotheca type ; a complex consisting of the aedeagus, phallotheca and endotheca, as treated in this paper.
Sac (of outer sheath). Broadening of the outer sheath immediately beyond its tube. Căpuşe used his own term, boulbe ejaculateur (of ductus ejaculatorius), or scleriductus.

Vesica (endophallus). Toll applied this term to the distal part (tube) of the outer sheath ; Căpuşe (in part) named thus the membranous portions of the phallotheca.

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I wish to express my thanks to Dr. J. Buszko, Toruń, Poland for providing some material for study, Dr. N. P. Kristensen, Copenhagen, Denmark for a fruitful discussion, Dr. E. Warchałowska, Kraków, Poland for the photomicrographs and to an anonymous referee for correcting the English text.

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Proutia rotunda sp. n. (Lepidoptera, Psychidae) — a bag-worm moth species confused with *P. betulina* (ZELLER)

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Summary

The taxon known as *Proutia betulina* (ZELLER) in northern Europe does not correspond to a syntype (here designated as lectotype) of that species. The northern species is described as *P. rotunda* sp. n. It is characterized by shorter branches of the bipectinate antenna and a more roundish forewing than in *P. betulina*. The new species seems to be distributed mainly in northern Europe and in northern parts of Central Europe, while *P. betulina* seems to be restricted to Central Europe, occurring southwards to northern Italy.

A few years ago I received from Mr. Peter HÄTTENSCHWILER some specimens of *Proutia betulina* (ZELLER, 1839), collected by him at Mendrisio, southern Switzerland. When comparing these with Finnish specimens identified as the same species, I noticed that the two sets of specimens showed clear differences. Particularly the structure of the male antenna was so different that I could not consider the two taxa as conspecific.

Proutia betulina was described on the basis of specimens from Glogau, now in western Poland. A syntype is preserved in the British Museum (Natural History), and by my request Dr. Kevin TUCK sent me photographs of it. The specimen is labelled "Lectotype" [circular, purple-edged label ; as far as I know the lectotype was never validly designated] / "Betulina Bartsch [?-o-] lit 3/56" [by ZELLER] / "Epichnopteryx betulina Z. Is. 39, 183. Spey. Is. 46, 34. HS v p. 63. anicanella Br. 73" [by ZELLER] / "Psychidae slide no. 75 leg, antenna" / "BM ♂ genitalia slide no. 3318". The specimen is here designated as lectotype.

The lectotype corresponds with the specimens from Mendrisio, whereas the specimens from Finland belong to another, seemingly undescribed species. This is described here.

Fig. 1. *Proutia rotunda* sp. n. ♂ Finland, U : Pyhtää, H. LUOMA leg.

Fig. 2. *Proutia betulina* (ZELLER, 1839), ♂ Switzerland, Mendrisio, P. HÄTTENSCHWILER leg.

Proutia rotunda sp. n.
(Figs 1, 3, 5 and 6)

HOLOTYPE : ♂, labelled "Fennia, Al : Lemland, Vesteränga, 7.VII.1946, Lingonblad" / "Holotype Proutia rotunda SUOMALAINEN" [red label] (deposited in the Zoological Museum, University of Helsinki).

PARATYPES : 17 ♂♂ 7 ♀♀ : Finland : Al : Lemland, Vesteränga 1 ♂ 7.VII.1946 LINGONBLAD leg. and 2 ♂♂ 20.VII.1952 H. BRUUN leg., Lemland 1 ♀ 1987 T. & K. NUPPONEN leg. ; U : Porvoo/Borgå 2 ♂♂ 5 ♀♀ 20.V.1948, 17.VI.1949, 19.VI.1949, 11.VII.1950, 16.VII.1951, 5.VI.1957, 12.VI.1957 E. SEPPÄNEN & A. STRANDMAN leg. ; U : Pyhtää 5 ♂♂ 19.VI.1973, 26.VI.1973, 29.VI.1973 H. LUOMA leg. ; EH : Nastola 2 ♂♂ 1948 HEINÄNEN leg. ; Lempäälä 1 ♂ 2.VII.1942 E. SALO leg. ; Denmark : Alleröd 1 ♂ 31.V.1979 M. FIBIGER leg. and 1 ♂ 22.4.1962 K. LARSEN leg. ; Hviding 1 ♂ 16.V.1970 K. LARSEN leg. ; Lilleröd 1 ♀ 24.IV.1962 M. FIBIGER leg. Paratypes in the Zoological Museum, University of Helsinki, in Coll. E. SUOMALAINEN and in Coll. P. HÄTTENSCHWILER.

ETYMOLOGY : Lat. fem. adj. *rotunda* = round, from the roundish wing shape of the new species.

DIAGNOSIS : The male of *Proutia rotunda* differs from the closely related *P. betulina* (Figs 2, 4 and 7) in the more roundish wing shape and, particularly, in the shorter branches of the bipectinate antenna. In the female, the caudal hair tuft is snowy white (light grey in *P. betulina*).

DESCRIPTION : ♂ : Wingspan 12.0-14.5 mm, average 13.5 mm (n = 12) (5 ♂♂ of *P. betulina* had a wing span of 12.0-13.5, average 12.5 mm). Intercalated cell present at terminal end of forewing discoidal cell. Tip of forewing more rounded than in *P. betulina* ; forewing and hindwing colour grey brown, sometimes darker than in *P. betulina*. Forewing with broad scales (class V-VI sensu SAUTER 1956 : 489), seemingly not differing from those of *P. betulina*. Length of antenna as in *P. betulina* ; antenna on average with 22 segments (in *P. betulina* 21). Length of side branches of bipectinate antenna usually about 70% of those in *P. betulina*. In three males of *P. rotunda*, ratio of length of side branch of fifth segment from base (two basal segments not counted) / length of segment 2.0-2.3 (in 12 ♂♂ of *P. betulina* from Coll. HÄTTENSCHWILER 2.8-3.8 ; within population variation considerably less). Male genitalia (Fig. 5) as in *P. betulina* (according to P. HÄTTENSCHWILER, in litt., genitalia of this genus show few specific differences).

Fig. 3. *Proutia rotunda* sp. n. ♂ antennae, Finland, U : Pyhtää, H. LUOMA leg.

Fig. 4. *Proutia betulina* (ZELLER, 1839). ♂ antennae, Switzerland, Mendrisio, P. HÄTTENSCHWILER leg.

5

6

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Fig. 5. Male genital armature of *Proutia rotunda* sp. n. Finland, U : Pyhtää, H. Luoma leg.
Fig. 6. Larval case of *Proutia rotunda* sp. n. ♂, Finland, Sippola, H. Luoma leg. (Drawing : H. Luoma).
Fig. 7. Larval case of *Proutia betulina* (Zeller, 1839). ♂, Switzerland, Mendrisio, P. Hättenschwiler leg.

♀ : Caudal hair tuft snowy white (in *P. betulina* light grey). Antenna with 10-12 segments (in *P. betulina* 10-16, Hättenschwiler & Chao 1990). In two females ratio of lengths of third and first legs 2.0 and 2.06 (in *P. betulina* 1.4, Hättenschwiler & Chao 1990).

Larval case (Fig. 6) : Larger than in *P. betulina* (Fig. 7), with pieces of stems of Poaceae, and with lichens and other material collected from the surface of tree trunks and stones (the cases of *P. betulina* are shorter and smoother, Fig. 7).

Biology : In Finland the species has been observed in deciduous and mixed forests, mainly on warm, but mesic, southern slopes. The larval cases are fixed on trunks of birch (*Betula*) or rowan (*Sorbus*), or on the sides of large stone blocks, usually in well protected and shady places. The adults emerge usually in June or early July (Seppänen 1966, H. Luoma in litt.).

Distribution : *P. rotunda* is relatively rare in Finland but has been observed from the provinces A, V, U, EK, St, EH, ES, EP and KP (Kyrki 1978), i.e. from the southern coast at 60° N to about 64° N. The taxon reported from Sweden is clearly *P. rotunda* ; it has been found in the southern part of the country from about 55° to 59° N (Nordström et al., 1961). In addition, the species has been observed from Denmark (see type material) and from the German Federal Republic : Waldeck (Staudinger leg.). The general distribution of the species remains to be determined.

Remarks

P. betulina is known to me from western Poland, Glogau (the type material), from the German Democratic Republic, Mark Brandenburg (M. Weidlich leg.), from the German Federal Republic : Baden, Rastatt (A. Biebinger leg.) and from Switzerland, Mendrisio (P. Hättenschwiler leg.). In Coll. Hättenschwiler, *P. betulina* is present, in addition, from the following localities : German Federal Republic : Duisburg ; Bavaria, Münchshofen ; Italy : Garda, Vesano ; Czechoslovakia : Prag ; Belgium : Mol ; Switzerland : Yverdon ; Herrliberg ; Biasca ; Dorenaz ; Uster.

For the distribution of other *Proutia* species, see Hättenschwiler & Chao, 1990. The recently described *P. chinensis* Hättenschwiler & Chao, 1990 has equally long branches of the antenna as *P. betulina*. *Proutia salicicolella* (Bruand, 1853) and *P. eppingella* (Tutt, 1900)

are junior synonyms of *P. betulina* (ZELLER, 1839) (HÄTTENSCHWILER, 1978).

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Takapsestis fascinata sp. n. from China (Lepidoptera, Thyatiridae)

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Summary

Takapsestis Matsumura, 1933 is known to include 5 species from India to Sundaland and Taiwan. A further species, *T. fascinata* sp. n., is described from China and two Indian species are added to the genus.

In a previous paper (Yoshimoto, 1983), the genus *Takapsestis* Matsumura, 1933 was redefined and found to comprise 5 species from South-East Asia :

T. wilemaniella Matsumura, 1933 (Taiwan) type species
T. orbicularis (Moore, 1888) (West Himalaya to Sikkim)
T. bifasciata (Hampson, 1896) (Sikkim)
T. sumatrensis (Gaede, 1930) (Sumatra)
T. semiobsoleta (Warren, 1915) (Java)

These are characterized in the male genitalia as follows : simple socii, small lobes and short terminal processes of the sacculus, and a mass of short spines on the vesica. Here I describe a new species from China, transfer further two species to the genus, and present two new synonyms.

Takapsestis fascinata sp. n. (Fig. 1)

Holotype : ♂, labelled "A-tun-tse (N. Yünnan), Talsohle ca. 3000 m, 23.6.1937. H. HÖNE", "Tafel IX, M. R. 3", "Slide HY-1490, ♂", preserved in the Museum Alexander Koenig, Bonn.

Paratype : 1 ♀, same locality as holotype, July 3, 1937, H. Höne, genitalia slide K. Werny, GU : 0391, preserved in the Museum Alexander Koenig, Bonn.

Description ♂ ♀ : Length of forewing 18-19 mm, expanse 37-39 mm. Antennae lamellate. Eyes hairy and lashed. Third segment of palpus

two-thirds as long as 2nd. Tegulae greyish ochre, with a dark brown transverse band. Patagia brownish grey. Abdomen greyish brown, with a black dorsal crest as in *T. orbicularis* (Moore) and *T. sumatrensis* (Gaede). Forewing dark grey with two conspicuous creamy white spots in cell and four minute discocellular creamy white spots ; median and postmedian lines black and conspicuous, space between them pale grey ; an apical streak black and thick ; subterminal line obsolete, weakly serrate ; cilia pale greyish brown, with dark brown rays beyond veins. Hindwing uniformly pale brown, cilia pale grey with diffuse brown line.

Male genitalia (Fig. 2) : Uncus and socii nearly equal in length ; tegumen broad ; valva gradually narrowed toward tip, with a short and thick terminal process of sacculus ; juxta wide, horseshoe shaped ; aedeagus moderate, with a short and curved caudal process ; vesica with a mass of short spines in regular rows.

Fig. 1. *Takapsestis fascinata* sp. n., holotype, ♂. China, N. Yunnan.

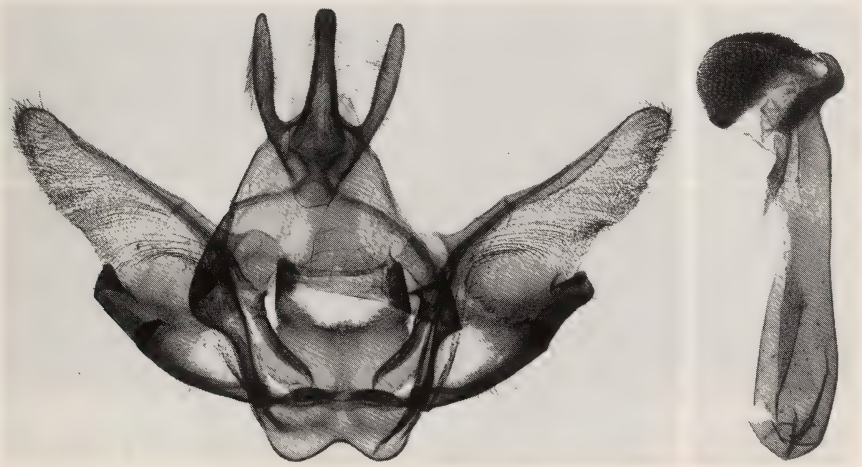


Fig. 2. Male genitalia of *Takapsestis fascinata* sp. n., holotype. China, N. Yunnan.

Female genitalia (Fig. 3) : Papillae anales roundish ; lamella antevaginalis a pair of large semicircular sclerites ; ductus bursae thick, corpus bursae large, roundish, with longitudinally elongate signum.

Fig. 3. Female genitalia of *Takapsestis fascinata* sp. n. paratype. China, N. Yunnan.

Distribution : China (Yunnan)

This species is most similar to *T. orbicularis* (Moore, 1888) (Fig. 4) from W. India and Sikkim, but is easily distinguished from it by the presence of a creamy white spot near the base of the cell. In the male genitalia, the new species is separated from *orbicularis* by the shorter uncus, a thicker and shorter terminal process of the sacculus, and a shallower cleft in the caudal margin of juxta.

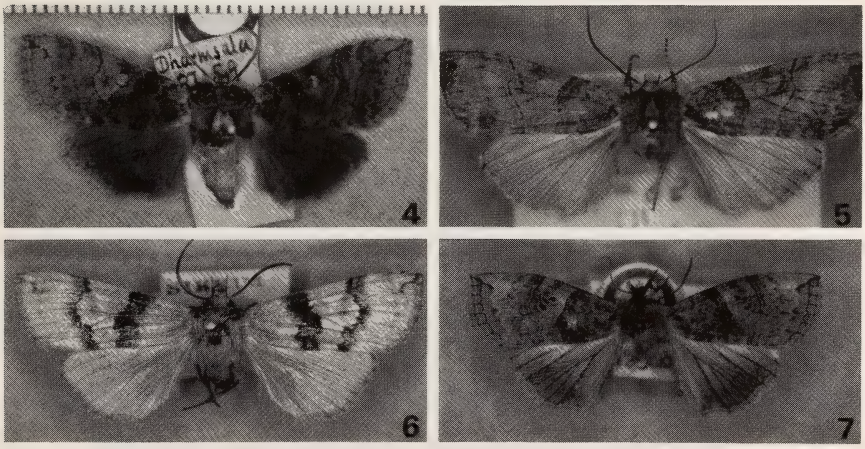
Neogaurena Roepke, 1944, *Natuurh. Maandbl.* **33** : 65, type species : *Neogaurena grisescens* Roepke, 1944, by monotypy. **Syn. n.** of *Takapsestis* Matsumura, 1933, *Insecta matsum.* 7 : 200, type species : *Takapsestis wilemaniella* Matsumura, 1933.

Neogaurena grisescens Roepke, 1944, *Natuurh. Maandbl.* **33** : 65, fig. 35. **Syn. n.** of *Palimpsestes* [sic] *semiobsoleta* Warren, 1915, *Novit. zool.* **22** : 156.

This species was described from West Java (Potachawattee and Kamodjan), but it is almost certainly the same as the Javanese *semiobsoleta* Warren.

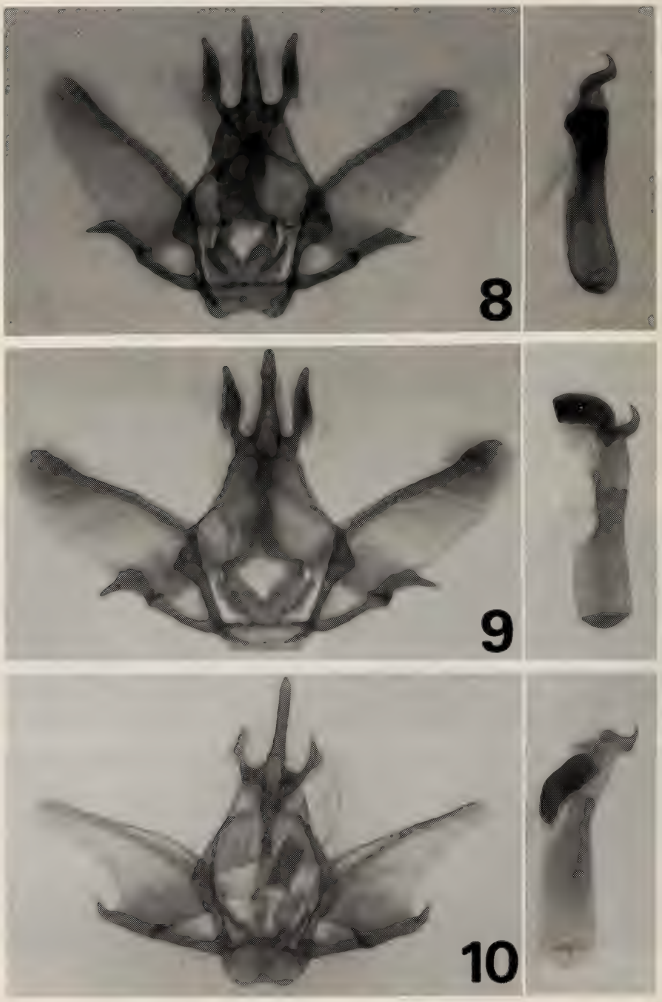
Takapsestis griseata (Warren, 1915), **comb. n.** (Fig. 5)

Polyploca griseata Warren, 1915, *Novit. zool.* **22** : 157 ; Yoshimoto, 1982, *Tyo Ga* : **32** : 119, 131, fig. 29.



Figs 4-7. *Takapsestis* spp. from India. 4 : *T. orbicularis* (Moore), ♂. syntype, Dharmsala. 5 : *T. griseata* (Warren), ♂, holotype, Kangra. 6 : *T. bifasciata* (Hampson), ♀, holotype, Sikkim. 7 : *T. curvicosta* (Warren), ♂, holotype, Khasia hill. All in British Museum (N.H.), London.

The male genitalia (Fig. 9) suggest that this species could be just a form of *T. orbicularis* (MOORE) (Fig. 8, male genitalia). However, the terminal process of the sacculus is a little longer and the distance between this and a small lobe before it is a little shorter than in *orbicularis*. *T. bifasciata* (HAMPSON) (Fig. 6) seems to have an abnormal maculation in comparison with its congeners. Its specific status should be investigated further.



Figs. 8-10. Male genitalia of *Takapsestis* spp. from India. 8 : *T. orbicularis* (MOORE), syntype. 9 : *T. griseata* (WARREN), holotype. 10 : *T. curvicosta* (WARREN), holotype.

DISTRIBUTION : W. India (Kangra).

Takapsestis curvicosta (WARREN, 1915), **comb. n.** (Fig. 7)

Polyploca curvicosta WARREN, 1915, *Novit. zool.* **22** : 156.

Male genitalia (Fig. 10). Uncus long and socius short ; valva narrow, with a curved terminal process of sacculus.

There is no subsequent record since the original description, and only the ♂ holotype is known. This species is distinguished from its congeners by its smaller size (expanse 32 mm) and strongly curved costa of the forewing.

DISTRIBUTION : E. India (Assam).

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Field notes — Kurze Exkursionsberichte — Excursions en bref

Kretania psylorita Freyer (Lepidoptera, Lycaenidae). Discovery of a new locality in Crete

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Summary

A number of observations on *Kretania psylorita* Freyer made in the Psyloritis Mountains in Crete in July 1986 are presented where the species is now menaced by anthropogenic activities. A new colony was discovered in the Dikti Mountains, about 60 km East of Mt. Ida (locus typicus). The habitat corresponds to the classical "Astragaletum" and is fortunately less easily accessible.

Kretania psylorita Freyer was described in 1845 as an endemic mountain species from the Psyloritis (Idhi) range in central Crete, in the Aegean sea. The highest peak in these mountains is Mt. Ida (2,456 m), which Greek mythology identifies as the place of Zeus' childhood. Various authors subsequently confirmed these findings (H. Rebel, 1916 ; E. Troníček, 1949 ; R. F. Bretherton, 1969 ; L. G. Higgins, 1973).

During a stay in Crete from July 1st to 20th, 1986, we devoted particular attention to this species. Unfortunately, we found that the "locus typicus" of *psylorita* is endangered. In fact, its former geographical isolation, in a mountainous region with difficult access, no longer exists : a wide road suitable for motor cars has replaced the original footpath that once necessitated a walk lasting several hours to reach the locality from Anogia. The habitat has been even more seriously damaged by the construction of a ski lift for winter sports.

During the first week of July both males and females were very abundant on the slopes of Mt. Ida, from the Nida plateau (1,300 m) to the top. This apparently disagrees with the data of other authors, e.g. Rebel, who found the species in mid June. *K. psylorita* is distributed unevenly throughout its habitat, becoming less common at high altitudes. It becomes active early in the morning, with a rapid and irregular flight over the bushes of a thorny *Astragalus* species that are the main component of the vegetation (Astragaletum). It also rests on these plants and on the ground, especially on stones

Fig. 1. The habitat of *K. psylorita* on the Dikti Oros Mountains.

Fig. 2. *Kretania psylorita* on *Astragalus*.

or to drink moisture from the soil. When frightened it darts away with a rapid and jerky flight. It is then hard to see on account of its dull brown colour and small size.

Only a few Rhopalocera flew synchronous and sympatric with *psylorita*, the most common of which was *Coenonympha thyrsis* Freyer, particularly at the foot of Mt. Ida ; *Polyommatus icarus* Rott. and *Hipparchia cretica* Rebel were found only occasionally.

E. Tronníček (1938) defines the association of symbiotic species, including *Zerynthia cretica* Rebel (which flies earlier), *Colias crocea* Fourc., *Pararge megera lyssa* Dsd. and *Vanessa cardui* L., as well as those listed above, as "Polyommatetum psyloritae".

Our subsequent excursions were to other mountains on Crete. From Omalos (1,000 m), on the western side of the island, we climbed the Leuka Oros (White Mountains) or Lefka Ori group to the top of the arid Mt. Gigilos, without entering the Samaria Gorges and ignoring the inner slopes of the higher Lefka Ori. *K. psylorita* was not found in these areas, on account of the lack of suitable habitat.

A very interesting and noteworthy finding was the discovery of *psylorita* in the Dikti Mountains (whose highest peak reaches 2,148 m), on the eastern side of Crete, about 60 km from Mt. Ida.

On July 10th, 1986, after driving to the picturesque Lassithi plateau, with its 1,000 windmills, and having reached the village of Psychron, one of us (G. Leigheb) walked up to the cave which is reputed to be the birthplace of Zeus (Dikteon Antron) and then went on further up the mountainside, which is strewn with boulders and holes, to a valley crossed by a path. In the background could be seen the highest peaks of the Dikti Oros, still partly covered with snow. Having passed numerous rocky buttresses, after a few hours walk, he reached the slopes of the highest peaks. From 1,300 m upwards, the vegetation shows the same features as the "Astragaletum" on Mt. Ida. The first specimens of *psylorita* were captured resting on the ground near a small spring at an altitude of approximately 1,500 m. About 30 other specimens were observed within a range of about half a kilometre. This colony was undoubtedly less numerous than the one on Mt. Ida. Both sexes were still fresh, in spite of the fact that it was the second week of July. The butterflies are absolutely identical with those collected in the type locality. Among those collected, specimens corresponding to forms "*caeca*" Courvoisier and "*obenbergeri*" Tronníček were not exceptional.

Discussion

The discovery of a new colony of *K. psylorita* suggests that certain endemic species considered to be strictly restricted to a single relict biotope may in fact be more widely distributed, albeit in scattered and isolated colonies. Systematic investigation of less easily accessible areas is often lacking.

Another feature to consider in the case of mountain species is the considerable variability of the flight period in relation to the climatic conditions. It is therefore not surprising that *psylorita* was found in mid-July rather than in June, which is considered its typical flight period.

A comparison between the classical biotope on Mt. Ida and the one on the Dikti and Lefta Mountains actually suggests the possibility that this species may be present on all of the three main maintain ranges of Crete, which are in fact not very far apart. The discovery of *psylorita* in this new locality on the Dikti Oros groups should therefore not be considered surprising, and it seems probable that it will subsequently be also discovered in the Lefka Ori.

Entomologists should search for new unexplored areas rather than collect repeatedly in the same localities !

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Book reviews — Buchbesprechungen — Analyses

ERHARDT Andreas. Wiesen und Brachland als Lebensraum für Schmetterlinge. Eine Feldstudie im Tavetsch (Graubünden). Denkschriften der Schweiz. Naturforsch. Ges. Bd 98. 158 S. Birkhäuser Verlag, Basel 1985.

Mit einer sehr schönen Farbtafel als Decke versehen (Magerwiese zur Blütezeit von *Paradisea liliastrum*), präsentiert sich dieses grossformatige Buch (23 × 31 cm) von ERHARDT.

Die Zielsetzung der Studie bestand darin, den Einfluss der Sozialbrache auf die tagaktiven Grossschmetterlinge zu untersuchen. Sozialbrachen sind Grünland das infolge der zunehmenden Industrialisierung der Landwirtschaft sich selbst überlassen wurde, also vor allem mühsam zu bewirtschaftende, wenig rentable Grenzertragsflächen an Hanglagen. Ausgewählt wurde das Tal Tavetsch (Vorderrhein, oberhalb Disentis) weil es sich für diese Zielsetzung am besten eignete. Die Lepidopterenfauna von Fettwiesen wurde übrigens auch untersucht. Schliesslich wurde noch die grundlegende Frage nach der Korrelation von Vegetationstyp und Lepidopterenfauna behandelt.

In drei Kapiteln werden die Untersuchungsflächen, die Transektmethode und die Auswertungsmethode dargestellt. Es folgt eine systematische Liste aller auf den Untersuchungsflächen gefundenen Arten (87 Tagfalter, 138 Heteroceren). Die Phänologie wird anhand von drei Arten (*C. gardetta, Z. exulans, E. euryale adyte*) exemplarisch diskutiert.

Im zentralen Kapitel (66 Seiten) wird die *Sukzession der Lepidopterenfauna auf fortschreitenden Brachstadien ungedüngter Magerwiesen und Extensivweiden* dargestellt. Die Diversität der Schmetterlingen ist in extensiv bewirtschafteten Vegetationstypen besonders hoch, wobei Extensivweiden die Magerwiesen an Arten deutlich übertreffen. Frühe Brachestadien weisen von allen untersuchten Vegetationstypen die höchste Diversität auf, spätestens mit Aufwuchsstadien sinkt die Diversität rapide.

Ein Vergleich von Nord- und Südhang zeigt, dass an Südhängen die Schmetterlingsfauna generell deutlich artenreicher ist als an Nordhängen, dass es aber noch Arten gibt, welche nur an Nordhängen gefunden werden, so z.B. *Erebia eriphyle* oder *Euphydryas intermedia**

Ein Kapitel über die Lepidopterenfauna von Fettwiesen belegt den Rückgang von Schmetterlingen, verursacht durch Düngung von Magerwiesen. Der

* *E. intermedia* war zuvor in der untersuchten Region der Zentralalpen noch gar nicht nachgewiesen worden.

Einfluss der Verbrachung auf einzelne Lepidopterenarten wird von 2 Tabellen und 60 Abbildungen dokumentiert. Ein Kapitel behandelt Diversität und Struktur der Schmetterlingsgemeinschaften.

Die Untersuchung zeigt, dass die Artenzahlen von Schmetterlingen und Pflanzen grundsätzlich eng miteinander korreliert sind (Wirtspflanzen der Raupen !), dass es aber auch Diskrepanzen in dieser Korrelation gibt, die durch Höhenlage, Bodenverhältnisse, vor allem aber durch die Bewirtschaftungsform (Mahd !) bedingt sein können.

Die Arbeit schliesst mit einer kritischen Diskussion der Konsequenzen für den Naturschutz und einer Zusammenfassung auf deutsch und englisch, welche drei aufschlussreiche Tabellen enthält (häufigste und charakterische Arten : Südhang und Nordhang), einer fünfseitigen Literatur-Auswahl und drei Verzeichnissen (der 37 Tabellen, 25 pflanzensoziologischen Aufnahmen und 89 Abbildungen, dazu noch 2 sehr schöne, ganzseitige Farbtafeln).

Als Fazit möchte der Referent aus der Zusammenfassung die Konsequenzen für den Naturschutz zitieren, weil sie am besten geeignet sind, die Nützlichkeit und Wichtigkeit der Untersuchung von A. Erhardt aufzuzeigen :

„Optimal wäre ein ausgewogenes Verhältnis möglichst vieler verschiedener Habitate, was aber Pflegemassnahmen auch in verschiedenen Brachstadien voraussetzt, da sich diese sonst zu mehr oder weniger klimaxnaher Waldvegetation entwickeln ; besonders gefährdet sind die extensiv bewirtschafteten Vegetationstypen, vor allem Magerwiesen. Ihre Erhaltung setzt die traditionelle Bewirtschaftungsform voraus“.

In Abwesenheit von vergleichbaren Untersuchungen kommt dieser Arbeit ein gewisser Pioniercharakter. Da die Unterhaltsmassnahmen in Schutzgebieten im allgemeinen auf die Bedürfnisse der Vegetation abgestellt sind, und da wir wenig oder nichts über die Tierwelt wissen, füllt nun z.T. die Arbeit von Erhardt diese Lücke. Die Kooperation Botanik und Zoologie ist in diesem Fall besonders hervorzuheben.

Das Buch von Dr. Erhardt muss wärmstens empfohlen werden für alle Natuschützer, und ganz besonders für ökologisch arbeitende Entomologen und Faunisten.

E. de Bros

Jutzeler David. Grundriss der Tagfalterfauna in den Kantonen Glarus, Schwyz und Zug. Berichte der Schwyzerischen Naturforschenden Gesellschaft. 9. Heft, S. 5-60, 1990 (mit 76 Verbreitungskarten, 35 Farbfotos auf 4 Farbtafeln, 26 s.w. Fotos)
Bezug dieses Heftes (solange vorrätig — Auflage 1000 Expl. —) durch Dr. Alois Bettschart, Schlappvig 12, CH-8847 Egg-Einsiedeln.
Preis : SFr. 35.—

An erster Stelle im schmucken 9. Heft der Schwyzer Nat. forsch. Ges.— Grossformat, Glanzpapier, farbige vordere und hintere Umschlagseite — steht

der Beitrag des sehr aktiven Naturfreundes und- Schützers, guten Schmetterlingskenners und ausgezeichneten Photographs JUTZELER zu Thema „Kartierung der Schmetterlingen" seiner Region, also der Kantone Glarus, Schwyz und Zug, veranlasst durch eine Anfrage seitens der Schwyzer Naturforschenden Gesellschaft.

Von 1987 bis 1989 hat der Autor nicht weniger als 34 Exkursionen ins Berggebiet unternommen und 28 Feuchtgebiete in den Kantonen Zug und Schwyz mindestens einmal besucht. Um seine Fundortsangaben zu ergänzen, hat er noch eine ganze Reihe von privaten Sammlungen und Photokollektionen durchgesehen.

So entstand der zentrale 2. Teil "*Die Artenvielfalt*" (37 Seiten), wo die 126 Tagfalterarten der drei Kantone systematisch geordnet aufgezählt und kurz beschrieben sind — mit deutschen und lateinischen Namen, alle Familien ausser den Hesperiiden (Dickköpfe) : 102 Arten im Kanton Schwyz, 93 im Kanton Glarus und ca 55 im Kanton Zug. Die interessantesten Arten (immerhin 76 von 126) erhielten neben den Fundortsliste auch eine Verbreitungskarte. Zusätzlich zu dieser Fundortsliste werden für jede Art der Biotop und die Futterpflanze der Raupe angegeben. Mit besonderen Signaturen werden auf den Verbreitungskarten die Stellen bezeichnet, wo ein Fund der betreffenden Art heute praktisch ausgeschlossen ist (o), sowie die Fundorte, die mit Sicherheit heute nicht mehr bewohnbar sind (†).

Im 3. Teil „*Lebensräume und ihre Schmetterlinge*" werden die Hochmoore, die Streuewiesen, die Nachbarschaft der Feuchtgebiete und die Magerwiesen und Wälder in warmen Lagen beschrieben, und mit guten Schwarzweissphotos illustriert. Als grosser Bergfreund präsentiert uns Jutzeler in vier Bergwanderungen vier verschiedene Schmetterlingsgruppen : Die Satyridae (Augenfalter), die *Argynnis* und *Melitaea* (Perlmutter- und Scheckenfalter), die Lycaenidae (Bläulinge) und die Papilionidae und Pieridae (Ritterfalter und Weisslinge).

Anschliessend : eine Distelfalterwanderung und Beobachtungen am Rigi-Kulm (beide von Dr. L. REZBANYAI-RESER, Luzern).

Der 4. Teil „*Schmetterlinge von damals*" enthält einen Bericht aus dem Tagebuch von Dr. Ris (1920, 1921) über eine Exkursion ins Todtmeer (ehemaliges Hochmoor des Sihlseegebietes), einige Passagen aus HEER über die Schmetterlinge im Glarnerland um 1846, sowie Beobachtungen von ZINGG (1939) und BUHOLZER (1947) über Schmetterlinge bei Weggis, Lützelau (Rigi).

Im 5. und letzten Teil „*Schmetterlinge mit besonderer Entwicklung*" werden schliesslich sehr interessante Beobachtungen über die ganz eigenartige Lebensweise der zwei bedrohten Bläulinge *Maculinea alcon* (Kleiner Moorbläuling) und *Maculinea rebeli* (Enzianbläuling) notiert. Diese beide Arten benötigen für ihre Entwicklung nämlich Ameisen, und beide sind stark gefährdet, so insbesondere *rebeli* im Glarnerland durch Störungen im Lebensraum, die sowohl die Futterpflanze (Deutscher Enzian) als auch die Wirtsameise (eine

Myrmica-Art) betreffen. Eine schöne Farbtafel illustriert verschiedene Lebensstadien dieser Bläulinge mit ihren Ameisen.

Die Arbeit schliesst mit :

1. der sehr nützlichen Erwähnung des Zentrums zur Kartierung der Fauna in Neuchâtel, das weiterhin Funddaten von Schmetterlingen entgegennimmt, um diese künftig auszuwerten.
2. dem Dank an die sehr zahlreichen Schweizer Kollegen, die mitgewirkt haben, und
3. einer sehr ausführlichen Literatur-Zusammenstellung (42 Zitate).

Dem Autor ist für seine aufwendige, minutiöse Arbeit im Gelände herzlich zu gratulieren, sowie für die gelungene schriftliche Aufzeichnung seiner Resultate. Seine Publikation verdient eine grosse Verbreitung, nicht nur bei den Spezialisten (Lepidopterologen), sondern bei allen Schweizer Naturfreunden. Sie mag ein nützlicher Ansporn für weitere ähnliche Untersuchungen seitens der leider zu seltenen Schweizer Tagfalter-Beobachter sein.

E. de Bros

SPULER, A. Die Raupen der Schmetterlinge Europas. Zweite Auflage von Dr. E. HOFFMANNS gleichnamigen Werk. 60 Tafeln mit über 2000 Abbildungen und den dazugehörigen Tafelerklärungen. Vorwort von A. SPULER, Erlangen, Weihnachten 1904. Reprint edition 1989, Apollo Books Lundbyvej 36, DK-5700 Svendborg. DK 780.- plus Porto.

Nach der hervorragend gelungenen „Reprint Edition" des vierbändigen Werkes von Jules CULOT „Noctuelles et Géomètres d'Europe", mit der erstaunlich genauen Wiedergabe seiner berühmten, handkolorierten 151 Tafeln (81 Tafeln Noctuidae, 70 Tafeln Geometridae), veröffentlicht nun unser rühriges SEL-Mitglied Peder SKOU das bekannte, mehr als 75 Jahre alte Standardwerk von SPULER.

Wieder ist die Reproduktion der 60 Farbtafeln — wohl das Wichtigste an einem solchen Buch — perfekt, wie der Rezensent beim Vergleich mit seinem eigenen Originalexemplar feststellen konnte. Neben den 3 alphabetischen Verzeichnissen der Ausgabe von 1904 (abgebildete Pflanzen — Arten deren Raupen oder Puppen abgebildet sind — Pflanzen) enthält die Repro Edition eine 27 seitige Einleitung mit dem Wichtigsten über Morphologie und Biologie (Eier, Raupen, Puppen), sowie über Raupensuche, -Zucht und -Präparation, mit einem Anhang „Beziehungen der Pflanzen zu den Schmetterlingen".

Obwohl seit 1904 sehr viel über Raupen veröffentlicht wurde, ist „der Spuler" das praktische und vollständigste Raupen-Bestimmungsbuch geblieben (für Schmetterlingsliebhaber). Durch die Neu-Auflage steht dieses seit langem vergriffene Werk nun zu einem annehmbaren Preis zu Verfügung. Seine Anschaffung kann jedem, der sich mit Raupen befasst, nur empfohlen werden.

Apollo Books gebührt für die Neu-Auflage vergriffener klassischer Werke der Lepidopterologie Dank und Anerkennung.

E. de Bros

Michael CHINERY : New Generation Guide to the Butterflies and Day-flying Moths of Britain and Europe. Edited by David Attenborough. Published in 1989 by University of Texas Press, P.O. Box 7819, Austin, Texas 78713 U.S.A. Hardbound, 320 pages, 13 cm × 30,5 cm. Cost : about U.S. $ 22.50.

It would probably be worthwhile to receive reviews of this book from (1) an advanced student of butterflies having a lot of training and experience, (2) an advanced student of moths with a minimal knowledge of butterflies, and (3) an amateur lepidopterist who is an enthusiastic beginner. I fit into the second category although I firmly believe that this book belongs on the shelf of all three categories. The book was not in my hands for more than a minute before I realized it was not „just another book on butterflies". Virtually all species of European butterflies and dozens of moths representing 20 moth families are figured in color. Illustrations of magnified eggs, early instar larvae, mature larvae, and pupae are shown in color alongside of many (not all) species ; range maps of each species are placed beside the text and figures of each species. It is extremely convenient to have everything on the same page, as opposed to the common practice of separate plates of adults, larvae, maps, and text all in different sections of a book. For the butterflies, each is illustrated with the upperside of left wings and body, and detached right wings showing undersides. The moths show upperside right wings spread open, and left wings folded down in natural repose, all four wings attached to the body.

There are numerous colored illustrations showing the insects on their hostplants and/or in their habitats. Pictures appear on almost every page. Under the text of each species one finds diagnostic characters, hostplants, months for each stage of the life cycle, status (common, rare, endangered, etc.), and a listing of countries which afford legal protection. The second half of the book has brief yet instructive chapters on various subjects including migration, metamorphosis, feeding behavior, courtship, conservation, natural enemies, and protective coloration. Much on these pages aims to explain why or how : Why does a certain species have eyespots ? Why does another live only in high mountains ? How does one live with ants ? Why is one endangered and its nearest relatives are not ? And many, many more how and why questions and answers. The book does not show subspecies, has no bibliography, and has no sections on collecting and collections ; I do not consider the lack of any of these to be shortcomings. Under some species, Liechtenstein is misabbreviated as „Leich".

The book has curatorial value. I was able to identify or verify identifications of most of the 159 specimens (at least 25 species) of *Zygaena* in the Denver Museum. The book will serve the same function eventually for the hundreds of European butterflies in this collection. Indeed, for lepidopterists outside of Europe who wish to own a single reference guide to all European butterflies in color, this book would be a good choice among the several which are

available. Chinery is to be commended for shifting the emphasis away from collecting and collections toward more noble pursuits such as field observations, gaining insight into the ecology of these animals, and conservation.

The book has a lot to offer at a reasonable price. I recommend it highly to all categories of lepidopterists. Hopefully, future editions in French, German, Japanese, etc. are already in preparation.

Richard S. Peigler

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Corrigendum

Napolitano, M., Descimon, H., et Vesco, J. P., 1990.

La protection des populations de *P. apollo* L. dans le sud de la France : étude génétique préliminaire (Lepidoptera, Papilionidae). *Nota lepid.* 13 (2-3) : 160-176.

Page 174. Fig. 6. La légende manque. Coller la nouvelle page 174 jointe au présent n° de *Nota lepid.*

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VI. Congress of European Lepidopterology
Sanremo 5-9.IV.1988

Summaries of the lectures
Zusammenfassung der Vorträge
Résumé des exposés

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Les travaux suivants ont été ou seront remis à Nota lepidopterologica pour publication :

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MIKKOLA, K. : A joint Finnish-Soviet lepidopterological expedition to NE-Siberia in the summer of 1987.
RAINERI, V. : *Horisme predotai* BYTINSKI-SALZ, 1936 – a separate species (Geometridae).
THOMAS J. : The five European *Maculinea* species (Lycaenidae) – recent discoveries in their ecologies. (John HEATH memorial lecture).

Nota lepid. 12 Supplement No. 1 : 4-6 ; 30.VI.1989 ISSN 0342-7536

Preface

This supplement to *Nota lepidopterologica* consists of the summaries of lectures presented at the 6th European Congress of Lepidopterology. The congress was held at Sanremo, in northern Italy from 5-9th April 1988 and was attended by over 120 lepidopterists from most European and some overseas countries.

The two main themes of the congress were Lepidoptera conservation, and evolutionary systematics and genetics. A total of 17 lectures were presented on these topics. The lively discussions at the end of each of these lectures demonstrated the topical nature of these subjects, and enabled the participants to exchange information and opinions. However, other important areas of interest to the modern lepidopterist were also represented. The eight lectures on faunistics and biogeography helped to fill gaps in our knowledge of the distribution of European Lepidoptera and demonstrated the continued importance of such studies, not least for the planning of nature protection projects. Detailed observations on the biology of the individual species and even populations are just as important. Seven lectures were presented in Sanremo on this topic. The importance of lepidopterology in applied entomology was underlined by two contributors. Questions of nomenclature and taxonomy were addressed in four lectures. Even the history of lepidopterology was represented, with two lectures. The SEL General Meeting was held on 7th April. A detailed account of this meeting appeared in *SEL News* 16 (1988).

Despite all these interesting lectures, many participants managed to find the time to explore the surrounding hills, although the weather was not very suitable for day-flying insects. However, some important observations were made on the microlepidoptera fauna, which we look forward to seeing published soon.

Congress participants on the Piazza Colombo near the Congress Centre Ariston.

Geleitwort

Der vorliegende Supplementband zu *Nota lepidopterologica* beinhaltet die Kurzfassungen der anlässlich des 6. Europäischen Kongresses für Lepidopterologie gehaltenen Vorträge. Der Kongress fand in Sanremo, Italien, vom 5.-9. April 1988 statt und wurde von über 120 Lepidopterologen aus den meisten europäischen und einigen überseeischen Ländern besucht.

Als Hauptthemen wurden die Gebiete Schmetterlingsschutz sowie Evolutionäre Systematik und Genetik angekündigt. Zu diesen Themen wurden insgesamt 17 Vorträge gehalten. Die regen Diskussionen nach diesen Beiträgen bestätigten die Aktualität der beiden Hauptthemen und erlaubten den Teilnehmern einen regen Informations- und Meinungsaustausch. Wie die vorliegende Zusammenstellung zeigt, wurden auch weitere Gebiete der modernen Lepidopterologie gut vertreten. Die acht Beiträge über Faunistik und Biogeographie halfen mit Lücken in der Kenntnis der Verbreitung der europäischen Schmetterlinge zu schliessen und wiesen auch darauf hin, dass solche Untersuchungen nach wie vor von grosser Bedeutung auch für die Formulierung von Naturschutzkonzepten sind. Ebenso wichtig sind genaue Beobachtungen zur Entwicklung und Biologie der einzelnen Arten und oft sogar einzelner Populationen. Zu diesem Themenkreis wurden in Sanremo sieben Vorträge gehalten. Die Bedeutung der Lepidopterologie in der angewandten Entomologie unterstrichen zwei Vortragende. Fragen der Nomenklatur und Taxonomie wurden in vier Beiträgen diskutiert. Auch die Geschichte der Lepidopterologie wurde in zwei Beiträgen gewürdigt.

Wednesday 6th April 1989 Congress Centre Ariston, Sanremo.
Opening of the Congress. From left to right :
Prof. Dr. Pietro Passerin d'Entrèves, Secretary of the Congress.
Prof. Dr. Emilio Balletto, President of the SEL.
Prof. Sergio Beer, Opening address.

Am 7. April fand auch die Generalversammlung der SEL statt. Detaillierte Berichte über dieses Ereignis wurden in *News* 16 (1988) veröffentlicht.

Trotz allen interessanten Vorträgen fanden manche Teilnehmer noch die Zeit um die nahen Hügel zu untersuchen, obwohl das Wetter nicht sehr günstig für Tagfalter war. Immerhin wurden einige wichtige Beobachtungen über die Mikrolepidopterenfauna gemacht.

Avant-propos

Le présent Supplément No 1 de *Nota lepidopterologica* groupe les résumés des exposés présentés lors du VIe Congrès Européen de Lépidopterologie à Sanremo, qui s'est tenu du 5 au 9 avril 1988, avec la participation de plus de 120 lépidoptéristes venus de presque tous les pays d'Europe et de quelques pays d'outre-mer.

Les deux principaux sujets traités furent la protection des Lépidoptères d'une part et la systématique et la génétique évolutionnaires d'autres part. Les discussions très animées qui suivirent chaque présentation confirmèrent l'actualité de ces deux thèmes centraux et permirent aux participants un large échange de renseignements et d'opinions. Comme le montre la Table des matières, d'autres domaines importants de la lépidopterologie moderne furent également abordés. Les huit travaux sur la faune et la biogéographie ont contribué à combler maintes lacunes de nos connaissances sur la répartition des Lépidoptères en Europe, et montré que les recherches de ce genre ont toujours et encore une importance considérable pour l'établissement des projets de protection de la nature. Tout aussi importantes sont les observations sur la biologie des espèces, et souvent aussi des populations. Sept exposés furent consacrés à ce sujet durant le Congrès de Sanremo. Deux orateurs ont souligné le rôle de la lépidoptérologie pour l'entomologie appliquée. Des problèmes de nomenclature et de taxonomie ont fait l'objet de quatre travaux. Même l'histoire de la lépidoptérologie a été abordée, et cela par deux participants.

L'assemblée générale de la SEL s'est tenue le 7 avril ; le procès-verbal de celle-ci (suivi d'un rapport du Conseil de la SEL sur la période du 9 avril 1986 au 5 avril 1988) a été publié dans *Nouvelles* No. 16 (1988).

En dehors de tous ces intéressants exposés, de nombreux participants ont trouvé le temps d'explorer les collines de l'arrière-pays, alors même que la météorologie ne fût guère propice à la sortie des insectes diurnes durant cette semaine. Malgré cela, quelques observations importantes ont été enregistrées sur la faune locale des Microlépidoptères.

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Applied entomologie – Angewandte Entomologie – Entomologie appliquée

Lépidoptères nuisibles aux cultures floricoles et moyens de lutte

Giuseppe BESTAGNO

Les cultures d'œillets, de première importance pour la floriculture industrielle de la «Riviera des fleurs», sont sujettes aux dégâts causé par les chenilles de deux Tortricides : la *Cacoecimorpha pronubana* HB., indigène, et l'*Epichoristodes acerbella* WKR. arrivée d'Afrique du Sud. Cette espèce exotique a rapidement vaincu l'espèce locale, si bien qu'elle constitue actuellement le 95% environ de la population totale des deux espèces.

Le rapporteur décrit en détail la biologie des deux espèces et les moyens employés pour les combattre, lutte à laquelle il a contribué par des expériences personnelles et en collaboration avec d'autres experts. Cette lutte se fonde maintenant sur deux moyens principaux qui visent à réduire l'emploi des pesticides chimiques, écologiquement dangereux : les phéromones contre les papillons et l'exposition des fleurs destinées à l'exportation aux rayons gamma qui tuent les larves cachées dans les tiges et les boutons. Cette dernière méthode, particulièrement étudiée par le rapporteur, a été proposée à la Communauté européenne, mais son adoption, quoique accueillie favorablement, n'a pas eu de suite officielle jusqu'ici.

Un autre lépidoptère nuisible aux œillets est la Noctuelle *Peridroma saucia* HB., à répartition presque mondiale : sa larve polyphage cause des dégâts, parfois graves, à nombre de plantes cultivées. À Sanremo et dans les environs, il est courant de trouver ces papillons en plein hiver. L'auteur signale encore : *Autographa gamma* L. (Noct.), qui attaque les marguerites ; *Spodoptera littoralis* BSD. (Noct.) dangereuse pour les plantes d'*Alstroemeria, Lisianthus* et *Gypsophila* ; *Bembecia uroceriformis* TR. (Sesiide) et *Uresiphita limbalis* D. & S. (Pyraust.) qui causent des dégâts aux cultures de genêt.

Adresse de l'auteur : Via Capitan Pesante 5, I-18038 Sanremo.

Nota lepid. 12 Supplement No. 1 : 8 ; 30.VI.1989 ISSN 0342-7536

Pine processionary moth (*Thaumetopoea pityocampa*) complex in Catalonia. Its geographical phenology and current methods of control

V. Sarto i Monteys, J. M. Vives & M. Rojo

This species is the most serious defoliator of pines (*Pinus*) and, to a lesser extent, cedars (*Cedrus*), in an area extending through south-central and southern Europe to North Africa.

In Catalonia pine processionary larvae attack more or less severely all native and introduced pine species occurring below 1500 m ; attacks on cedars are more unusual. Higher up, the much colder conditions stop their successful development. The most susceptible Catalan native pine trees are the Iberian-Austrian pine (*P. nigra* ssp. *salzmannii*) and the Scots pine (*P. sylvestris*). Among introduced pines, the Monterey pine (*P. radiata*) and the Canarian pine (*P. canariensis*) are heavily attacked.

Heavy defoliation, by itself, does not usually completely kill the trees – unless affecting very young ones –, however it seriously delays their growth and weakens them so that they become much more susceptible to secondary attack by other insect pests and pathogens.

A serious problem for people living in close proximity to infested areas is that the larvae are covered with urticating hairs that can produce painful allergies when contacting the human skin.

For all the reasons mentioned above Catalonia – and other affected communities – spend, year after year, large sums of money for research on biological and chemical control of this pest. However solutions are still far from conclusive and further research needs to be funded. The rather specialized biology of this species is probably the reason why it is so difficult to obtain permanent satisfactory results in its control.

In Catalonia, over the last seven years, and especially after the identification of the moth's sex pheromone in 1981, research has been focussed in three main directions : 1. Climato-geographical phenology of the adult stage, in relation to the main different climates within Catalonia. 2. Studies on the species' natural predators and parasites and 3. Studies on the killing efficacy of different selective chemicals sprayed – by aeroplane or helicopter – over extensive infected areas of pine trees.

The authors have been directly involved with research related to the first and third of these approaches. Provisional results indicate that adult coastal populations occur about one month later than inland ones, which is the opposite to what one would expect considering the milder climate. Coastal populations also have a shorter flying period (about one month shorter than inland ones).

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Conservation – Schmetterlingsschutz – Protection des Lépidoptères

On the conservation of butterflies in the northern High Rhön (Germany)

Otakar KUDRNA

The paper presented at the 6th European Congress of Lepidopterology constituted a summary of the author's publication "Die Tagschmetterlinge der nördlichen Hohen Rhön" which appeared in March 1988. The English summary of this book is reprinted here in a shortened form as a summary of the above lecture.

The present paper constitutes a comprehensive work on the butterflies of the northern High Rhön (Hohe Rhön, Germany : Bavaria & Hessen). The paper is based on a survey and research carried out by the author between 1984 and 1987 (including two complete vegetation periods in 1986 and 1987). The aim of the paper is to provide recommendation for the conservation of butterflies in several nature reserves, above all "Rotes Moor" and "Lange Rhön", as well as in other sites of special scientific interest in the Nature Park Rhön.

The High Rhön stretches vertically from about 500 m to just over 900 m ; it was originally covered by beech dominated woodland. The present landscape dominated by open grassland originated after massive felling of woodland in medieval times. The aim of conservation authorities is to maintain this open country by means of habitat management. The aim of the research described here was to provide data for a comprehensive management plan for the area. The habitat types include pastures (inhabited by very few butterfly species), wet meadows and limestone grassland (both very rich in butterflies), mixed woodlands and peat bogs.

In all 30 sites have been surveyed in an area of some 20 km across. The High Rhön was until recently poorly known from an entomological point of view. It is therefore quite surprising that a total of 89 butterfly species have been recorded (incl. some doubtful and old records) ; about 80 species have been found over the past four years ; three species recorded previously have not been confirmed, but are believed present (*Parnassius mnemosyne, Melitaea parthenoides, Pyrgus alveus*) ; one species is extinct (*Colias palaeno*).

Sites surveyed are described in chapter 3 ; reference is given to general and site-specific management ; some important localities are figured. The distribution of all species is shown in the form of tables. The following sites are of special scientific interest : Rotes Moor, Eisgraben, Maihügel, Steinschlag-Wiesen, Schwarzes Moor, Weinberg, Thürmleinwiese, Oberelsbach, Mühlwiese and perhaps also Himmeldunkberg and Holzberg ; Gangolfsberg and Hangen-Leite could also be counted to this group if *Parnassius mnemosyne, Melitea parthenoides* and *Pyrgus alveus* can be confirmed there.

Larval hostplants are listed in chapter 4.1 ; only hostplants recorded in the area and known to grow on the sites concerned are included, with reference to the type of larval biotope. Adult phenology is summarized in tables ; apart from the flight period, reference is given to a number of broods and to the hibernating stage.

Chapter 5 presents a comprehensive survey of all Rhön butterfly species. Reference is given to the distribution, larval ecology and adult phenology of each species, followed by short biogeographical characteristic of the species. Each monograph deals in detail with the history, distribution, biotop preferences and conservation of the species concerned. The following species are worthy of special reference :

Parnassius mnemosyne has not been found in the area since 1976 ; it is probably still present, but very rare and not easy to locate ; unfavourable weather in 1987 did not make the search easier. (Note : *P. mnemosyne* was confirmed in 1988 and a special paper devoted to the ecology of this species is in preparation).

Colias palaeno became extinct in "Rotes Moor" apparently after a massive afforestation of wet meadows adjacent to peat bogs with *Vaccinium uliginosum* after ca. 1950. The last reliable record of the species is nearly 50 years old. The habitat of this species has been restored. *C. alfacariensis* is quite common in limestone grasslands with *Hippocrepis comosa.*

Lycaeides argyrognomon, Maculinea arion, Polyommatus amandus, P. bellargus, P. coridon, P. damon, and *P. thersites* are confined to limestone grasslands in the south-eastern parts of the area, at an altitude of about 500 m. *P. coridon* is the commonest species of this group, *L. argyrognomon* has been found only on one occasion. *Maculinea nausithous* is represented in the area by one small colony only ; it urgently requires species-specific management and monitoring.

Boloria aquilonaris has only two relatively (and unusually) small colonies in both large peat bogs, "Rotes Moor" and "Schwarzes Moor". *B. eunomia* flies with *B. aquilonaris* together and in addition to this inhabits some wet meadows with *Polygonum bistorta,* mostly adjacent to peat bogs. Its colonies are very strong and could possibly be counted among the largest populations of this species in Central Europe. *Brenthis ino* is one of the commonest butterflies here.

Euphydryas aurinia apparently disappeared from both its typical former sites ("Rotes Moor" and "Schwarzes Moor" ; it has only been found once in a habitat unusual for this species : xerotherm limestone grassland ("Weinberg").

Melitaea diamina is well represented ; *M. neglecta* has recently been discovered in the "Rotes Moor" ; it was probably treated as *M. athalia* in the past ; the identification is subject to confirmation : the taxonomic status of the species is uncertain. The occurrence of *M. parthenoides* is subject to confirmation.

Coenonympha tullia has apparently disappeared from two of its former sites : "Rotes Moor" and "Schwarzes Moor", where it is known to have occurred ; the last small colony of this species was discovered in "Thürmleinwiesen".

Chazara briseis was found on two occasions only ; its discovery was unexpected. Even more surprising is the absence of *Hipparchia semele* and *Coenonympha glycerion*, species not rare in limestone grasslands adjacent to the High Rhön.

Apatura iris, *A. ilia*, *Limenitis camilla* and *Erebia aethiops* inhabit some mixed woodlands at lower levels, up to about 500 m ; *E. ligea* and *Argynnis paphia* are widespread and locally abundant. A few mostly old records of *Iphiclides podalirius* and *Aporia crataegi* are questionable ; it can be assumed that these species do not live in the area.

It is strongly recommended to reintroduce *Colias palaeno* to its former site "Rotes Moor" as its habitat is believed to have been restored. The reintroduction would be unique in Germany ; if successful, it would enable an endangered species to recolonize a part of its former range and increase its total population. In addition to this, the attempt would provide valuable experience for similar future projects. Recommendations are made as to the future recording and monitoring of selected species and sites. It is made abundantly clear that the success of the conservation programme outlined in this paper depends entirely on the implementation of all recommendations made here ; the exceptionally rich butterfly fauna of the High Rhön is well worth all our efforts.

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Conflict and conservation : the El Segundo blue and the airport (Lycaenidae)

Rudi MATTONI

The largest remaining population of the El Segundo blue, *Euphilotes battoides allyni* is on the sand dunes at the west end of the Los Angeles International airport (LAX). The habitat, as an ecosystem, is deteriorating from alien plant invasion following severe disturbance of 75% of the site. The major threat to the butterfly are two species of microlepidoptera which are predators as larvae. These endemic moths are now significant because of the introduction of a secondary foodplant which permits them to build their populations in advance of the butterfly. When the butterfly appears (it is univoltine), the moths virtually overwhelm it. Other extirpations, and the position of these dunes as the last in southern California, make them a unique heritage.

To restore and preserve this habitat, airport planning proposed a recreation facility, including a golf course, on about 80 ha of the part of the dunes which are essentially completely disturbed. The funds from the project would be used to restore and provide management for the 36 ha which could be a conservancy and preserve. The plan was rejected by the political body charged with regulating coastal growth, an action supported by part of the environmental activist community. The irony is that without development of some part of the property the entire habitat value will be lost.

In the meantime, the airport commission has provided emergency funds sufficient to augment the habitat to reduce immediate pressures and authorized a major study to provide a detailed biological survey and evaluation of the fine grain habitat value over the entire property.

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Was bedeutet das neue Naturschutzrecht der Bundesrepublik Deutschland für die europäische Entomologie ?

Hermann MORGENROTH

Innerhalb eines Kurzvortrages alle Aspekte des neuen Naturschutzrechtes des Bundesrepublik Deutschland zu erläutern ist nicht möglich. Doch 20 Minuten dürften vollkommen genügen, wenn auf das Wesentliche hingewiesen werden soll.

Naturschutz im heutigen Sinn wird weltweit erst seit etwa 150 Jahren betrieben. Umfassende gesetzliche Vorschriften sind in Deutschland erst seit rund 50 Jahren bekannt – Reichsnaturschutzgesetz 1935 –. Einen umfassenden Artenschutz für Schmetterlinge gibt es hier erstmals seit 1980 – Bundesartenschutzverordnung.

Die Ausführungen über das neue Naturschutzrecht von 1987 sind deshalb so wichtig, weil diese Gesetze als Vorbild im Zuge der Harmonisierung des Rechtes in der EG dienen könnten. Was könnte für die europäische Entomologie wichtig werden und was hat ein ausländischer Entomologie in der Bundesrepublik zu beachten ?

Die Bestimmungen des Bundesnaturschutzgesetzes können vollinhaltlich bejaht werden mit wenigen dafür aber stark einschneidend wirkenden Bestimmungen. Es sind hauptsächlich drei, die ins Auge fallen. Erstens : die generelle Befreiung einer „ordnungsmässigen Land- und Forstwirtschaft“ von den Einschränkungen des Bundesnaturschutzgesetzes – etwa 80% der Fläche der Bundesrepublik werden hiervon betroffen –. Zweitens : die Regelung der Ausnahmebestimmungen und der hierfür zuständigen Behörden. Drittens : die in die Artenschutzliste – Anlage zur Artenschutzverordnungen aufgenommenen Schmetterlingsarten.

Zu erstens : anscheinend werden die Gefahren für die Natur nicht gesehen, die hier insbesonders von einer sehr intensiv ausgerichteten Landwirtschaft ausgehen.

Zu zweitens : hier sind die Ausnahmegenehmigungen über Fangen, Inbesitznahme, Besitz, Nachweis eines rechtmässigen Besitzes, Verbringen – hier ist der grenzüberschreitende Verkehr besonders stark berührt – und Verkauf durch sehr komplizierte Verfahren stark behindert. Hinzu kommt, daß für die verschiedenen Ausnahmegenehmigungen jeweils auch verschiedene Behörden zuständig sind. Für Fangerlaubnis ist in einigen Ländern eine Stelle in anderen, z.B. Nordrhein-Westfalen sind es örtliche Stellen, also für das Land insgesamt 54 untere Landschaftsbehörden jeweils auch nur für ihren engen Bezirk.

Je weiter die Genehmignungsbehörden nach unten verlagert sind, desto geringer ist auch die Fachkenntnis der über die Genehmigung entscheidenden Personen. Da das Schwergewicht des Naturschutzrechtes beim Arten- und nicht beim Biotopschutz liegt, glauben viele Genehmigungsbehörden durch das Versagen einer Fangerlaubnis

den Forderungen des Naturschutzgesetzes am besten zu genügen. Es gibt z.B. in Nordrhein-Westfalen untere Landschaftsbehörden, die grundsätzlich keine Genehmigungen zum Fang von Schmetterlingen erteilen.

Die Anlage zur Bundesartenschutzverordnung – Liste der besonders zu schützenden Arten – ist praktisch eine Zusammenstellung der „Roten Listen". Die Einhaltung des Schutzes der aufgeführten Schmetterlingsarten setzt eine Kenntnis voraus, die sich ein Entomologe erst nach langer und intensiver Beschäftigung aneignen kann. Eine solche Kenntnis sich aus Büchern anzueignen erscheint kaum möglich. Zudem sagt die Liste nichts aus über die Nomenklatur nach der sie aufgestellt ist. Wenn also Gattungen oder sogar Familien unter den Schutz des Gesetzes fallen sollen, muß die Nomenklatur klar genannt sein, da je nachdem welche Nomenklatur man nimmt, die Anzahl der dem Schutz unterstehenden Arten um 100 Stück oder sogar noch mehr differiert, was wiederum zu einer unerträglichen Rechtsunsicherheit beiträgt. Auch fehlen in der Liste Arten, die bei einem Vergleich mit der Liste in diese gehörten – z.B. fehlt *Eudia spini* – und andere.

Durch die Aufnahme in Artenschutzlisten ist meines Wissens bisher keine Art wirksam geschützt worden. Auch wenn man Vögel und Schmetterlinge nicht miteinander vergleichen kann, so hat ein seit über 50 Jahren praktizierter Artenschutz ein Verschwinden von Arten aus ihrem bisherigen Verbreitungsgebiet nicht verhindert. Auch für die Schmetterlinge wird sich ein gleiches sicher herausstellen. Dem Schutz der Schmetterlinge dient meiner Ansicht nach allein ein verstärker Biotopschutz.

Was kann in Zukunft getan werden ? In der Bundesrepublik Deutschland ist eine Änderung des Gesetzes und der hierzu ergangenen Naturschutzverordnung auf absehbare Zeit nicht möglich. Hier wäre es Sache der mit Entomologie Beschäftigten, sich dafür einzusetzen, daß ein Klima geschaffen wird, in dem Ausnahmegenehmigungen leichter zu erhalten sind. Den Entomologen der übrigen Länder kann nur empfohlen werden, sich auf Länderebene zusammenzuschließen, Kontakte zu in der Gesetzgebung maßgeblichen Personen herzustellen und ein Klima zu schaffen, daß durch Sachkenntnis und nicht durch Emotionen geprägt ist.

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Legislation for Lepidoptera conservation – towards a rationale

M. G. Morris

Conservation legislation exists in most European countries. It affects the conservation of Lepidoptera both directly and indirectly. Most direct legislation is orientated towards the protection of species, and much of it is aimed at 'protection' from collectors. However, it is important to integrate species protection with habitat conservation, including biotope management where this is necessary.

Much legislation is based on the concept of 'protected species'. Superficially this is similar to the concept of 'endangered species', but the philosophy underlying these terms is very different. It is suggested that 'endangered species' is the more useful concept because it more closely relates species to their habitats and leads to positive conservation in the form of recovery plans.

Although conservation legislation may have a variety of aims, its most important entomological objective is the maintenance (and possibly enhancement) of populations of endangered species. To do this, effective habitat conservation is an absolute requirement. Habitat and species legislation should be closely linked. An example is the Bern Convention. However, as invertebrate species have only recently (1987) been placed on the Appendices of this Convention, and because legislation on habitat conservation has not yet been fully worked out, the effectiveness of the Convention is not so far apparent on the ground.

Lawyers, administrators, conservationists and field entomologists all have different viewpoints on legislation. In order to refine effective legislation from these sources, it is necessary to examine in detail the ecology of threatened species, the nature of perceived threats, the measures for recovery of populations that are most likely to succeed, and the response of populations to more general conservation management. The insect ecologist thus has a key rôle in effecting good conservation legislation.

It is apparent that there continue to be misunderstandings between those involved in legislation for wildlife conservation. It is important that misunderstandings be resolved if the effectiveness of legislation is to be recognised and improved.

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Biology and conservation of the endangered lycaenid species of Sierra Nevada, Spain

M. L. Munguira, J. Martin

The Sierra Nevada, with its highest peak of 3482 m, is the southernmost range of mountains in Europe with a genuine high-altituide tundra ; together with its biogeographic isolation this is the reason for its high percentage of endemics of the fauna and flora.

A total of five Lepidoptera, two Orthoptera, more than fifty Coleoptera and around one hundred plant species are endemic to the study area. These are some examples of the uniqueness of the Sierra Nevada. Ten butterflies have been listed in the Spanish Lepidoptera Red Data Book (Viedma & Gomez-Bustillo, 1985) of which seven are lycaenids. Four of these lycaenids fly in low mountain habitats and can also be found in other Spanish localities. The other three lycaenids are endemic to this Sierra, where they live at high altitudes in places almost devoid of vegetation, but with plant communities peculiar to the area, and over carboniferous schists.

The table summarizes our knowledge of the biology of Sierra Nevada's endangered lycaenids.

All the species considered are single brooded and those species associated with ants in the larval stage are facultative myrmecophils.

Plebejus pylaon and *Iolana iolas* have not been collected by us in the study area, although they have been recorded in it and we have found them in localities very close to the Sierra with very similar characteristics.

In the Iberian Peninsula, we consider a species to be endangered when it is present in less than 20 UTM 100 km^2 squares, vulnerable when present in 20 to 50 squares and rare when it is found in more than 50 squares, but is not frequent through its range. In our study *Lysandra golgus* and *Agriades zullichi* that are endemic to Sierra Nevada should be considered endangered. *Iolana iolas* should be added to these two species because although present in 30 squares in Spain it is extremely rare, and its populations are vulnerable due to several anthropogenic factors. *Plebejus pylaon* and *Cupido lorquinii* should be listed as vulnerable and *Aricia morronensis* and *Lysandra nivescens* as rare although *nivescens* is fairly common in Spain. *A. morronensis* lives in many Iberian localities, but subspecies *ramburi* is restricted to the Sierra Nevada despite being quite abundant there in suitable habitats.

For the conservation of the seven species we suggest the creation of a protected zone in almost all the high-altitude tundra (121 km^2), and plots of some plant communities of lower levels. This would protect the seven butterfly species and the great majority of the insect and plant endemic species of the Sierra.

	I. iolas	*P. pylaon*	*C. lorquinii*	*L. nivescens*	*L. golgus*	*A. zullichi*	*A. morronensis*
Vegetation & character	Clearings of *Quercion rotundifoliae* forests, seral		*Astragaleto-Velletum* seral		*Arenario-Siderition glacialis* climacic		
Substrate	limestone or gypsum		carboniferous marble		carboniferous schists		
Foodplant	*Colutea atlantica*	*Astragalus alopecurioid.*	*Anthyllis vulneraria*	*Anthyllis vulneraria*	*Anthyllis v. arundana*	*Vitaliana primuliflora*	*Erodium cheilantifol.*
Part. foodpl.	seeds	leaves	seeds	leaves	leaves	leave/fruit	leaves
Relationships with ants	none	*Camponotus, Plagiolepis, Formica & Crematogaster*	*Plagiolepis, Tapinoma*	no data	*Tapinoma*	amirmecophil	*Tapinoma*
Overwintering stage	pupa	larva III	pupa	larva III	larva III	larva III	larva III
Flying period & maximum	V-VI V	V-VII V	III-VII V-VI	V-VIII VI-VII	VII	VII	VII-IX VIII
Nr. instars	4	5	4	5	5	5	5
Sexual behav.	patrolling	patrolling	patrolling	perching	perching	patrolling	patrolling
Nr. 10 km sq.	30	37	33	88	3	3	44 (4 in ssp. *ramburi*)
Height (m)	800-1200	800-1200	900-1700	800-2000	2500-2700	2550-3000	2050-3000

Due to the climacic character of the higher oromediterranean plant communities (*Arenario-Siderition glacialis*) the best way to conserve this zone would be to leave it alone and reduce human impact to the lowest possible level. The other two seral zones (those of the seral *Astragaleto-Velletum* communities and those placed in clearings of the climacic *Paeonio-Quercetum rotundifoliae* forests) would only need slight control to maintain the actual clearings of the forest and a moderate grazing. Traditional land uses such as beekeeping and goat and sheep grazing, can be allowed to continue because they do not alter the habitat of the four species living in lower supramediterranean levels. On the contrary, these land uses will probably help to conserve the successional stages as they are at present.

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The importance of woodlands in the conservation of butterflies in the centre of the Iberian peninsula

J. L. Viejo ([1]), M. G. de Viedma ([2]) and E. Martínez Falero ([3])

The butterfly fauna of 51 sites in the centre of the Iberian peninsula were compared. The sites fall into three areas : the Southern Iberian Mountains, the Middle Tagus Depression and the province of Ciudad Real, in accordance with data recently published by different authors.

For each site four variables indicative of wealth of fauna were calculated :

(1) Number of species (NS).
(2) Average biotope amplitude ($\overline{BA}$). This is an estimation of the rarity value of the butterfly fauna from a site.
(3) Average chorological index ($\overline{CI}$). This is the index proposed by Kudrna (1986), and it is an estimation of the biogeographical value of the butterfly fauna from a site.
(4) Diversity (DI). It is obtained by using the Shannon & Weaver index.

We grouped the 51 sites according to their geographical area. To each of these zones, with the assumption that the variables are quantitative with roughly normal multivariant distribution, a principal component analysis was applied to define a gradient for the sites as a function of the variables available. The application of this analysis made it possible to represent the sites on single axes, which explain respectively 78% and 82% of the variance in the Tagus Depression and Ciudad Real, and in the Iberian Mountains on two axes which explain 88% of the variance.

The main results were that the Iberian Mountains, Lusitanian oak (*Quercus faginea*) and holm oak (*Q. ilex*) woods (outstripping *Juniperus thurifera* and pine woods) contain the most interesting fauna, i.e. the largest number of species, high average chorological indices, high diversity and low average biotope amplitude. In the Tagus Depression high values were found in Lusitanian and kermes (*Quercus coccifera*) oak woods ; in Ciudad Real in the Pyrenean oak (*Q. pyrenaica*) forests of Sierra Madrona and, to a lesser extent, in the holm oak woods in the north of the province. The richest butterfly communities are thus linked to *Quercus* woodlands, mainly Lusitanian, Pyrenean and kermes oaks. Marshy and intensely farmed areas, on the other hand, are less rich.

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We therefore believe a very close correlation to exist between plant formations and lepidopterous fauna. This correlation may help those interested in selecting sites for the establishment of natural reserves to recommend criteria on which to base conservation priorities. It would be most worthwhile to carry out similar studies on other groups of less conspicuous species. There is no a priori reason, after all, to believe that the most eye-catching species to be under greater threat than the less conspicuous ones. Moreover, greater stress must be laid on the protection of biotopes than on the protection of species.

Spain is a relatively large country (in western European terms) where knowledge about the precise distribution, abundance and ecological requirements of the majority of butterfly species as well as the threats hanging over them is scarce as yet. In this context, what THOMAS and MALLORIE (1985) term ecosystem conservation as opposed to a species approach to butterfly conservation would seem to be the most effective policy.

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Mellicta athalia Rott. : An example of successful Lepidoptera conservation in the United Kingdom

M. S. Warren

The UK has a relatively long-established conservation movement which has aimed to protect a representative network of habitat, covering all the major types that occur. However, many nature reserves have lost their populations of rare or declining butterflies, largely due to insufficient or incorrect habitat management. In recent years, several threatened species have been studied in great detail and their ecological requirements are now much better known. A common theme has been the discovery of the importance of traditional forms of habitat management, which when applied to reserves has enabled far more effective conservation of the butterfly fauna. This lecture will examine the history of the conservation of one of the most endangered UK species, *Mellicta athalia.*

M. athalia once occurred across southern Britain, but has declined very seriously during the 20th century. The first national survey in 1980 identified only eight remaining localities, which contained numerous, mostly small, populations. At that time, two reserves had been established primarily to conserve large populations of the species, but both had virtually become extinct. From 1980-85 a detailed ecological study was conducted which discovered that the species mainly occurs in short-lived, transitional habitats. Its main breeding habitat remains suitable for only 5-8 years after cutting and the species requires the continual cutting of new areas of woodland in close proximity so that it can move from clearing to clearing. In the past, such conditions were provided by coppicing, which was the traditional form of woodland management throughout lowland Britain. Most woods were cut on a strict rotation of 8-15 years which provided ideal habitats for *M. athalia.* During the 19th and 20th centuries the practice declined rapidly, resulting in numerous local extinctions of the butterfly. Today, less than 2% of Britain's woods are coppiced and most of this is chestnut coppice in SE England, which is the last major stronghold of the species. In SW England, coppicing has ceased entirely and *M. athalia* has survived only by using two completely different types of habitat, often with different foodplants. The ecology of these alternative habitats will be discussed briefly.

The recommendations of the study have subsequently been applied to several nature reserves, with spectacular results. On the Blean Woods National Nature Reserve, numbers have risen from less than 20 adults in 1980 to over 5,000 in 1986. Nearly all the remaining sites are protected in some way and most are responding very well to new management initiatives. Also, the species has been successfully reintroduced to a few former localities where coppicing has been re-started. On a reserve in Essex, 53 adults were released in 1984 and by 1986 the population had reached over

4,000 ! However, *M. athalia* is still threatened on some important sites which are still managed by commercial forestry companies. The Nature Conservancy Council is currently negotiating detailed management agreements with the owners but this will require regular annual expenditure indefinitely in order to maintain viable populations. The future of *M. athalia* in the UK is therefore firmly in the hands of conservationists, and, by applying traditional management procedures, the initial results have been very successful. In some cases, though, traditional management has had to be modified as we are now attempting to conserve the species on much smaller areas of land than it occupied formerly. This has only been possible through the application of detailed applied research.

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Evolutionary Systematics and Genetics – Evolutionäre Systematik und Genetik – Systématique et génétique évolutionnaires

Taxonomy and evolution in *Lycaena* (subgenus *Heodes*) (Lycaenidae) (*)

Luigi CASSULO, Paola MENSI & Emilio BALLETTO

Among the several subgenera of the broadly Holarctic genus *Lycaena* (FABRICIUS, 1807), the subgenus *Heodes* (DALMAN, 1816) is characterized by its short valvae, with a prominent spine on the dorsal margin (male), and a sclerotized ostium bursae (female).

The following taxa were considered for morphological and cladistic analysis : *Lycaena alciphron* ROTTEMBURG, 1775 ; *Lycaena ottomana* LEFÈBVRE, 1830 ; *Lycaena virgaureae* LINNÉ, 1758 ; *Lycaena miegi* VOGEL, 1857 ; *Lycaenus tityrus* PODA, 1761 ; *Lycaena bleusei* OBERTHÜR, 1884 ; *Lycaena subalpina* SPEYER, 1851. *Lycaena phlaeas* LINNÉ, 1761 was included in the study and treated as an outgroup. Characters selected were the following :

External morphology :

(1) an orange spot at anal angle of hind wings (males) 0 = no 1 = yes
(2) spots on forewings : absent (0), present (1)
(3) anal angle of hindwings : rounded (0), acute (1)
(4) series of white discal spots on und.hindwings : absent (0), present (1)
(5) basal dot on upperside hindwings : absent (0), present (1)

Male genitalia :

(6) penis normal (0), elongate (1)
(7) penis apex turned downwards (0), upwards (1)
(8) valva : dorsal and ventral margins parallel (0), curved (1)
(9) valva : spine on dorsal margin proximal (0), distal (1), absent (2)
(10) genitalia normal size (0), large (1), very large (2)

Female genitalia :

(11) lamina supravaginalis bilobate (0), whole (1), reduced (2)

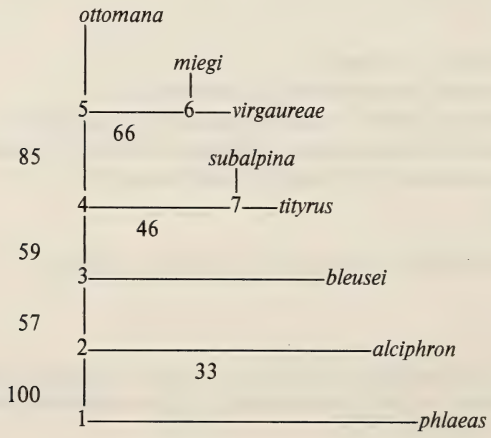
(*) This research was financially supported by the Ministry for Public Education (MPI) under 60% research funding program (Biogeography of Circum-Mediterranean lands) and the National Research Council (CNR).

Multistate characters (9-11) in the original data set (not reported) were transformed into binary by J. FELSENSTEIN's (1985) program FACTOR in his PHYLIP package. As a consequence in the following table characters 9, 10, 11 occupy columns 9,10 ; 11,12 and 13,14, respectively.

Character-state data

Factors	+-+-+	-+-++	--++
phlaeas	11101	01011	1100
alciphron	11101	11110	1000
bleusei	11101	11110	0000
tityrus	01101	11100	0000
subalpina	01001	01100	0000
virgaureae	10010	10100	0011
miegi	11010	10000	0010
ottomana	11000	00000	0010

A cladistic analysis was carried out on these characters using FELSENSTEIN's PHYLIP package. The tree shown below conforms to maximum criteria of parsimony (19 steps, program PENNY), likeliness (BOOT) and compatibility (CLIQUE). Figures below or to the left of connecting lines indicate percent likeliness of the preceding knot by a bootstrap estimate (BOOT).



Steps in each character :

	0	1	2	3	4	5	6	7	8	9
0		1	1	2	1	1	3	1	3	1
10	1	1	1	1	1					

From	To	Any steps ?	State at upper node
	1		11101 ?1?1? 1?00
1	*phlaeas*	maybe	..... 0.0.1 .1..
1	2	maybe	..... 1.1.0 .0..
2	3	yes	.... 0...
3	4	yes	..?.. ...0. ....
4	5	yes	..0.0 .0?.. ..1.
5	*ottomana*	yes	..... 0.0.. ....
5	6	yes	...1. ..?.. ....
6	*miegi*	maybe	....0.. ....
6	*virgaureae*	yes	.0... ..1.. ...1
4	7	yes	0.?.. ....
7	*subalpina*	yes	..0.. 0.... ....
7	*tityrus*	maybe	..1.. ....
3	*bleusei*	no	....
2	8	no	....
8	*alciphron*	no	....

All of these taxa are characterized by unique genitalic features and all qualify as separate morphospecies.

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An inconsistency in the methodology of cladism

U. Dall'Asta

Cladism is becoming a classic methodology for many lepidopterists in constructing a classification. At the species level this methodology has now become well known and can be considered a three stage process. First comes the study of the actual specimens : as many characters as possible are scored, ordered or measured and their polarity determined. All this information is put into a data matrix. The second step is feeding all this data into a computer. This computer calculates the phylogenetic affinities and prints this information out as a series of cladograms. The choice between these cladograms is performed by the way of a posteriori changing of polarities or weighting of characters. This results in a new data matrix, which is again submitted to the computer, this procedure being repeated until a satisfactory classification is obtained. The third step is the description of the finally obtained cladogram and the comments on the classification which can be inferred from it.

It is clear from the above analysis that the taxonomist has two stages in his own hand : the first, being the study of the organisms and the preparation of the data matrix, and the second, the description of the finally obtained cladogram and classification. But what about the theory and the methodology that were the basis for an algorithm used to make the computer program ? It is self-evident that before using a methodology its internal consistency must be verified.

According to Hennig (1981), considered the father of the cladistic methodology, characters of organisms can be divided into two categories : the plesiomorphic (ancestral characters) and the apomorphic (evolutionary novelties). According to him, organisms should not be classified by using their plesiomorphic character states, only by using their apomorphic ones. This poses a problem at the moment of splitting into two sister taxa as outlined by him (loc. cit., p. 25). Between the moment of splitting and the acquisition of its own apomorphic character later on, there arises a problem with the classification of the sister taxon with the plesiomorphic character due to the above mentioned principle (its only difference with the sister taxon being a plesiomorphic character).

For this problem Hennig (1981 : 25) proposes three solutions to classify the sister taxon :

a. classifying it as belonging to the ancestral line
b. classifying it as a new taxon, the distinctive character being its sister group relation and
c. considering it a structural type, which means that it is classified using other characters as is done by typologists, without distinction of plesiomorphic or apomorphic ones.

What surprises most is that Hennig does not propose a final solution, and that this problem never arises elsewhere in his publications. The reason for this is to be found

in his graphical representations of phylogenetic groupings. If one only takes into account his explanation of the phylogenetic process, the drawing of a last branching of a cladogram could be represented as in fig. 1, an asymmetrical drawing. But HENNIG's (1981 : 7) representations on the other hand look like fig. 2, symmetrical.

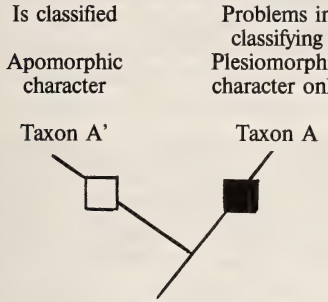

Fig. 1

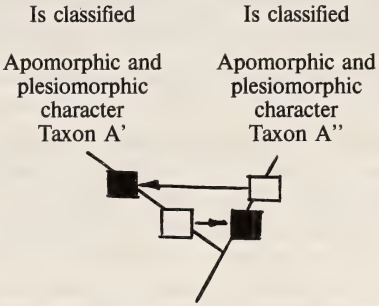

Fig. 2

It is clear from both figures how the problems of classifying the taxa having as the only difference with their sister taxon one plesiomorphic character has been solved : in those taxa an apomorphic character is postulated at the same time. In other words, according to this graphic representation, apomorphic characters always arise in pairs, otherwise there would be a problem in classifying the taxon situated in time between the origin of both apomorphic characters. But the fact that apomorphic characters always arise in pairs goes obviously against the general accepted ideas of phylogeny and particularly against the explanation of the phylogenetic process by HENNIG himself.

The outline of this problem has been submitted to Dr. PLATNICK (Am. Mus. Nat. Hist., New York) and his comments were that this analysis is completely irrelevant. The methodology of cladism has to be considered from the point of view that organisms should be classified on plusses (apomorphic characters) and not on minuses (plesiomorphic ones) and that not doing it in this way (as the former pheneticists) leads to less satisfactory classifications. But this does not solve the problem outlined above. HENNIG himself found as the only solution for the problem of not using plesiomorphic characters for classifying, joining apomorphic and plesiomorphic characters in pairs. The programmers obviously do not consider the fact that apomorphic characters arise in pairs a Hennigian principle, however, they claim that his principles form the basis of their programs. Consequently the question remains whether this logical deduction incorporated by HENNIG himself in his graphical representations does not imply an inconsistency in his methodology.

Reference

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Expériences d'hybridation intra- et interspécifiques dans le genre *Zerynthia* (Papilionidae). Relativité des critères mixiologiques de l'espèce.

Henri Descimon et François Michel

Le genre circumméditerranéen *Zerynthia* comprend deux espèces. La première, *Z. rumina*, possède une distribution atlanto-méditerranéenne : Maghreb, Péninsule ibérique, Sud de la France. La seconde, *Z. polyxena*, ponto-méditerranéenne, s'étend du Sud-Est de la France à l'Asie Mineure, avec des colonies allant jusqu'à l'Autriche. Elles sont largement sympatrides dans le Languedoc oriental et la Provence. Il existe une très relative exclusion mutuelle au niveau phénologique et écologique, qui n'empêchent pas une cohabitation fréquente. On a signalé des accouplements interspécifique et un seul cas précis d'hybride interspécifique naturel.

Chaque espèce possède des sous-espèces peu nombreuses mais prononcées. Les populations maghrébines et andalouses de *Z. rumina* sont bien distinctes des populations françaises (ssp. *medesicaste*), de même que les populations grecques de *Z. polyxena* de celles de France (ssp. *cassandra*).

À l'aide d'expériences diversifiées de croisements, nous avons tenté de préciser la nature et l'importance des barrières agissantes et potentielles entre les divers taxa, subspécifiques et spécifiques.

A. Croisements entre taxa géographiquement éloignés de la même espèce (*Z. polyxena* France × *Z.p.* Autriche ; *Z.p.* France × *Z.p.* Grèce ; *Z. rumina* France × *Z.r.* Algérie, Maroc et Andalousie). Les résultats sont les suivants :

- l'attirance entre les sexes est toujours forte et, entre individus compétents (mâles vigoureux, femelles très jeunes), l'accouplement se réalise spontanément sans aucune barrière. Une seule exception a été observée (sur un nombre significatif d'essais), entre des individus d'origine marocaine et provençale. Aucune des tentatives acharnées des mâles n'a produit d'accouplement ; la disparité de taille semble être la raison principale de l'échec (les individus marocains étaient trop grands).
- les accouplements sont toujours féconds et les F1 bénéficient d'une vigueur hybride spectaculaire et sont d'une grande homogénéité.
- les F2 (F1 × F1) sont au contraire irrégulières. Dans le croisement *Z. polyxena* France × *Z.p.* Autriche, la viabilité demeure excellente et se maintient dans les générations suivantes. Au contraire, avec *Z.p.* France × *Z.p.* Grèce, une baisse de viabilité sensible (50 à 75%) apparaît ; elle diminue sensiblement dans les générations ultérieures. Dans le croisement *Z. rumina* France × *Z.r.* Andalousie, la viabilité de la F2 était très faible (autour de 5%) ; même les rétrocroisements avec les souches parentales montraient une viabilité faible. La mortalité frappe tous les stades, alors qu'ailleurs elle se concentre sur les stades embryonnaires.

B. Croisements interspécifiques : nous avons effectué des tentatives entre tous les taxa mentionnés plus haut et les souches françaises de chaque espèce, dans les deux sens chaque fois que cela était possible. Voici nos résultats :

- il n'y a pas de barrière précopulatoire comportementale ; quels que soient les insectes mis en présence (en particulier qu'ils proviennent de populations cohabitant avec l'autre espèce ou non), les mâles sont vivement attirés visuellement par les femelles et tentent l'accouplement avec acharnement. Au contraire il y a des barrières mécaniques importantes : l'intromission est difficile à réaliser et échoue très souvent ; même obtenu, l'accouplement est souvent «boîteux» et dure ou trop longtems (plus d'une heure) ou pas assez (moins de 25 mn).
- Une barrière physiologique existe aussi très probablement : même dans le cas d'accouplements apparemment normaux, les pontes subséquentes ont été stériles, à une exception près, dont les résultats vont être détaillés.

C. Le seul accouplement interspécifique fécond a suivi une *double* fécondation : une ♀ *polyxena* (France) a d'abord été fécondée par un ♂ *rumina* (France × Andalousie) puis par un ♂ *polyxena* ; la descendance a comporté moitié d'hybrides et moitié de *polyxena*.

À partir de là, une série de rétrocroisements a été effectuée sur 5 générations (voir schéma). Les tentatives non marquées sur ce schéma ont échoué ; pratiquement toutes les combinaisons possibles ont été tentées. En F2, les deux rétrocroisements avec les espèces parentales ont réussi ; en F3, non seulement les croisements avec l'espèce parentale la plus proche ont réussi, mais aussi ceux avec l'espèce la plus éloignée. En F4, nous avons obtenu 12 accouplements entre les rétrocroisements «5/8» symétriques ; un seul s'est montré viable, et faiblement (9 chenilles sorties de l'œuf et 9 adultes) ; nous n'avons malheureusement pas pu continuer à suivre cette lignée «médiane», trop peu nombreuse. De même, un croisement entre hybrides a été réussi en F5 (11/16 *polyxena* × 13/16 *rumina*), mais il n'a pu engendrer de lignée ultérieure.

Chaque fois qu'un parent d'espèce pure était impliqué, la fécondité et la viabilité étaient excellentes ; il semble donc qu'un stock haploïde homogène soit suffisant pour assurer celles-ci. Une dose même minoritaire du génôme d'une espèce suffit à assurer la fécondité de l'accouplement avec un individu pur de cette espèce. L'échec du rétrocroisement «5/8 *polyxena*» × *rumina* semble être dû, là encore, à une incompatibilité de taille. Il n'a pas été observé d'asymétrie dans la fécondité des sexes, ni de distortion du sex ratio, ni de déséquilibre sensible dans la régulation de la diapause.

La viabilité des deux croisements mettant en jeu des hybrides des deux côtés est beaucoup plus faible. Un «hybrid breakdown» important se manifeste au cours des stades précoces du développement : beaucoup d'embryons sont retrouvés à l'intérieur de l'œuf arrêtés à des stades divers. En revanche, la chenille éclose, la viabilité devient normale.

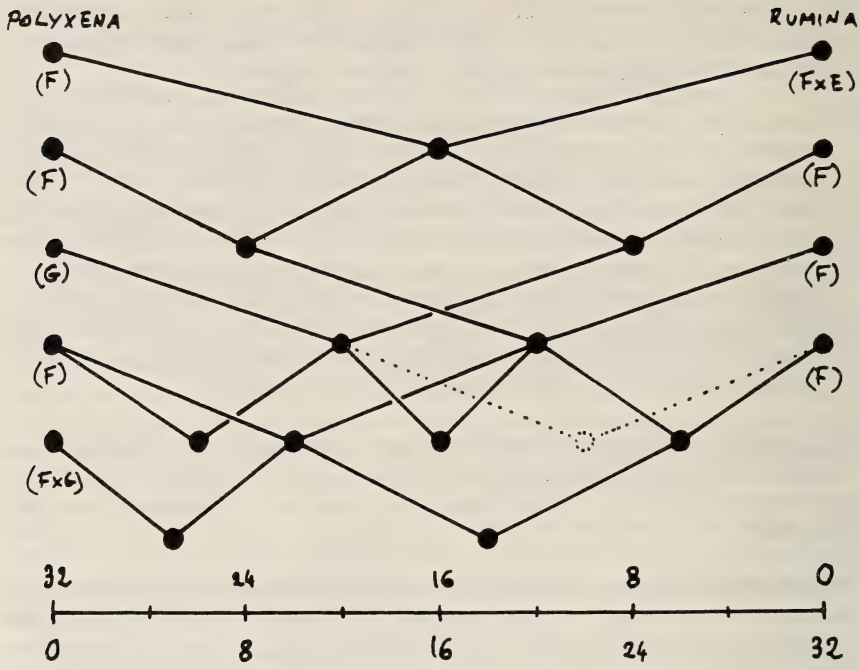

Fig. 1. Cinq générations de croisements entre *Zerynthia polyxena* et *Z. rumina*. La position des points représente la «distance» de chaque lignée obtenue par rapport aux espèces parentales. F : lignée d'origine française, E, espagnole (Málaga), G, Grecque (Delphes). En pointillé, le rétrocroisement «5/8 *polyxena*» × *rumina* qui, malgré un extraordinaire acharnement des mâles, a échoué car les femelles étaient trop grosses.
NB : les croisements ont souvent eu lieu dans le sens femelle hybride × mâle sauvage ; ceci n'est pas dû à une fécondité différentielle, mais à la plus grande efficacité sexuelle des mâles de la nature.

Les *Zerynthia* sont des Papilionoïdes primitifs, où les mécanismes d'isolement semblent assez rudimentaires. Cependant, les résultats exposés ici soulignent à la fois la multiplicité des barrières et leur relativité. Les facteurs précopulatoires jouent un rôle essentiel dans la séparation des pools géniques (l'intromission non suivie de fusion gamétique est, en dernière analyse, de nature précopulatoire). La stérilité des hybrides F1 semble au contraire avoir peu d'importance ici. Les incompatibilités génômiques, barrière ultime, agit fortement dès la F2, mais peut-être pas pour tous les gènes, car elle n'empêche pas les rétrocroisements.

L'importance des critères mixiologiques dans la définition des espèces est indéniable. Il nous paraît cependant abusif d'accorder une valeur absolue aux croisements expérimentaux (*a fortiori* s'ils utilisent l'accouplement artificiel). Des populations

éloignées géographiquement de continuums spécifiques indiscutables montrent une incompatibilité qui aurait pu autoriser, dans le cas de distributions discontinues, à les séparer spécifiquement. Au contraire, une fois les barrières précopulatoires enfoncées, des échanges géniques peuvent avoir lieu. Seules les situations naturelles peuvent servir à la définition des taxa.

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Eucheira socialis WESTW. (Pieridae) – Loss of genetic variation as a consequence of the population biology and anthropogenic range extension

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Eucheira socialis WESTW. is a pierid butterfly, recorded only from Mexico, which has a bizarre population biology. The gregarious larvae construct silken nests on the branches of the host plant, emerging only at night to feed. They pupate inside the nest, and a substantial proportion of the adults remain there, mating, ovipositing, and dying within. Flight ability of the adults is strongly limited. In fact, wing venation of the females is reduced and laboratory observations show that the butterflies from most localities can hardly glide. However, not all populations show the same degree of reduced dispersal capacity. Individuals from populations in the north-west of Central Mexico (Durango, Sinaloa) can fly, although weakly, and they also show morphological variation (ssp. *westwoodii*). This is not true for the southern Mexican populations (ssp. *socialis*). Moreover, our observations show that only very few females, although mated, lay more than a few eggs. This population biology results in extremely frequent sib-matings and reduced dispersal capacity.

Population genetics theory predicts a low degree of genetic variation for such a case as inbreeding tends to reduce polymorphism. In fact, enzyme electrophoretic results show that there is no genetic variation within and among all southern Mexican populations (ssp. *socialis*) at 32 loci, except one locality in which at one locus a different electromorph is fixed in all nests. In contrast, there is polymorphism in the *westwoodii* populations at three loci. The electromorphs found in *socialis* are also observed in *westwoodii.*

These observations can be explained by the following scenario : *Eucheira socialis* originally lived in NW-Central Mexico. The species, represented by today's ssp. *westwoodii,* already had a biology that allowed only a reduced gene flow caused by frequent sib-matings and limited flight abilities. In historic times the species became spread anthropogenically into the southern Mexican states as an item of commerce (the Aztecs used the nests as paper and the larvae and pupae are edible). This range extension was accompanied by a bottleneck event which resulted in the total loss of flight ability and polymorphism. The outcome is a taxon, ssp. *socialis,* that has no known means of dispersal and is genetically extraordinarily depauperate. Its survival is perhaps only guaranteed by the relatively stable environment the taxon is living in and is maintaining by the construction of nests, and its management by the native people of montane Mexico.

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Ghost moths and their primitive allies : towards a groundplan reconstruction for the suborder Exoporia

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The "ghost" or "swift" moths, *Hepialidae*, familiar to European lepidopterists, appear to be strangely isolated moths. However, some of their primitive allies, such as some members of the Australian genus *Fraus*, have overall commonplace "microlepidopteran" facies (slender bodies, "normal size" antennae) and distinct proboscis remnants. Recent anatomical studies on *Fraus* have helped in making detailed inferences about the structure of ancestral hepialoids and have led to a new interpretation of the enigmatic hepialid male genitalia, bringing these more in line with conditions in other homoneurous moths. Ongoing anatomical work on the endemic New Zealand superfamily *Mnesarchaeoidea*, the putative sistergroup of the *Hepialoidea*, is yielding additional insight into the groundplan of the "next higher" taxon, i.e. the superorder *Exoporia*.

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Experimental evidence for a specific distinction between *Colias hyale* L. and *C. alfacariensis* RIBBE (Pieridae)

Z. LORKOVIC

In response to occasional assertations that *Colias alfacariensis* RIBBE (= *australis* VERITY) is no more than an ecological form of *C. hyale* L., the experimental evidence for their genetical reproductive isolation is reported.

Material

Experimental crossings between both taxa were made with *C. hyale* from Zagreb, Croatia, N.W. Yugoslavia, and *alfacariensis* from N.E. France (Vézelay, kindly supplied by H. DESCIMON) as well as from the Istrian coast of Quarnero, during the years 1978-1980.

Methods

Pairings were made in cages 25 × 25 × 25 cm or in green netting, without frame, placed over naturally growing plants. The males were taken partly from the field during their patrolling flight, when they were most disposed to mate.

Results

1. No natural pairing between five *alfacariensis* females and seven *hyale* males could be achieved, even when three of the exhausted males were replaced by fresh ones for 25 minutes. The same was the case with four *hyale* females and *alfacariensis* males. In contrast, the females used in the experiments copulated almost at once with the conspecific males. Therefore, the ethological sexual isolating mechanism between both taxa is fully developed in both directions.

2. Despite resistance to pairing by the females, five crossings with *alfacariensis* females and *hyale* males as well as two crossings of *hyale* females and *alfacariensis* males were achieved through the gynanaesthetic pairing method of the author (with anaesthetized immobilised females and conscious males) of normal mating duration. After two or three days normal oviposition followed with 60 or more eggs daily.

3. The fertilisation was normal, as in the conspecific breeding experiments.

4. Development of the F_1 larvae was normal, without losses, and fine, large adults emerged, three to four times more males than females. The hybrid males and females paired freely, sometimes with hesitation if with males of the paternal species.

5. The F_1 hybrid females from five matings were entirely infertile, depositing a very reduced number of mostly immature and deformed eggs. Such female sterility and the corresponding failure of the F_2 generation, is a common trait of interspecific hybridisation in butterflies. However, the F_1 hybrid females were highly fertile, and in the backcrosses with *hyale* or *alfacariensis* females produced a fine and viable R_1 generation. The ability for producing R_1 is a characteristic of closely related species. Moreover, the males of R_1 were also fertile, while the eggs of the females began to develop, but seldom reached the black head stage.

6. The uniform green colouring (without markings) of the *hyale* larvae is in the F_1 generation dominant to the more bluish-green of the *alfacariensis* larvae as well as to their sharply delimited dorso-ventral and suprastigmatal bright yellow lines, while the segmentally arranged black patches between and below the lines appear very reduced or in traces in only 4-5 percent of F_1 individuals. The dorsal yellowish lines occur only seldom as undefined interrupted pale yellowish lines or stripes. One of the genes for the dark spots is probably located on the Z (X) chromosome of *alfacariensis*, and passes in the crossing to the female sex so that it can be expressed in a single dose in spite of its recessivity.

7. As expected, the backcrosses give different phenotypes, depending on the parental species used.

8. The unusually great larval variability in the F_1 can be attributed to the great natural variability of the *alfacariensis* black colour, which varies from heavily black quadrangular patches to minute rounded spots. The black patches and the yellow lines are two independent genetic characters.

C. alfacariensis seems to be the only European *Colias* with such a prominent larval colour pattern, and this seems to have had an important selective advantage in the evolution of this species. Mimicry with the similarly brightly coloured and strongly patterned unpalatable larvae of the Zygaenidae, living on the same Papilionaceous plants, is proposed.

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Electrophoretic investigations in the *Polyommatus (Lysandra) albicans* – *P. (L.) hispanus* complex (Lycaenidae)

Paola MENSI, Luigi CASSULO & Emilio BALLETTO

Among members of the genus *Polyommatus*, species of the subgenus *Lysandra* represent another taxonomically rather complicated group, which has undergone a number of changes. Members of the *P. (L.) coridon* (or the 'blue' complex), were the subject of a recent paper (MENSI et al., 1988). We shall therefore examine here the other W. Mediterranean taxa (the *P. albicans*, or 'white complex'). Contrary to the 'blue complex', the latter comprises both normal monovoltine and bivoltine populations.

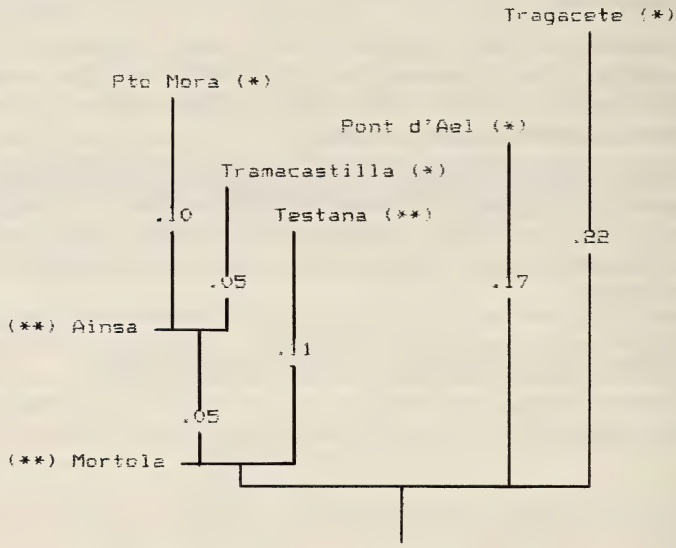

Fig. 1. Phylogenetic relationships within some populations of the *Polyommatus* (subgenus *Lysandra*) *albicans* complex obtained through J. FELSENSTEIN's (1985) CONTML program based on CAVALLI-SFORZA's chord measure. Branch lengths were set as to show a rough correspondence with electrophoretic distances (figures). Distances not significantly different from zero were set as zero (no figure reported). One or two asterisks indicate that the population is mono- or bivoltine, respectively.

Polyommatus coridon (population from Pont d'Ael : N Italy) and *P. caelestissimus* (population from Tragacete : C Spain) were tentatively enclosed as outgroups, to root the tree.

The karyology of the 'white complex' was studied by DE LESSE (1960, 1969). Haploid chromosome numbers proved 82 for the monovoltine and 84 for the bivoltine populations. Accordingly they were sorted into *P. albicans* and *P. hispanus*, respectively. This solution has been followed by later authors ever since.

Genetic relationships were studied for two monovoltine (*Pto Mora* : Sierra Nevada, *Tramacastilla* : Teruel) and one bivoltine (*Ainsa* : Jaca) populations from Spain and two bivoltine populations (*Mortola* : Imperia, *Testana* : Genova) from NW Italy. Sixteen gene-enzyme systems (*Ak, Est-1, Est-2, Est-3, Fh, Got-1, Got-2, G6pd, Hk, Me, Mdh, Idh-1, Idh-2, Pk-1, Pk-2, 6Pgd*) were analyzed on Cellogel by standard electrophoretic procedures. Results are summarized in a cladogram (fig. 1).

Even though the number of populations so far investigated is rather low, results show that bivoltinism probably evolved more than once, for instance in NW Spain and C Liguria. A consequence of this finding is that either *Polyommatus (Lysandra) hispanus* does not represent a homogeneous (single) taxon, or alternatively, monovoltine and bivoltine populations might represent but one species.

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Structure génétique des populations de *Parnassius mnemosyne* (L.) dans le sud de la France. Étude biométrique et électrophorétique. (Papilionidae)

Michel NAPOLITANO

Une étude de la variabilité phénotypique et génotypique de 24 populations de *Parnassius mnemosyne* (L.) a été réalisée dans le Sud de la France (fig. 1). La plupart des colonies échantillonnées volent dans les Alpes, où l'espèce est répandue, ou dans les massifs périphériques. Le papillon existe également dans le Massif Central et les Pyrénées, où deux échantillons ont été prélevés.

L'étude biométrique a porté sur douze des paramètres les plus caractéristiques des ailes, qui ont été mesurés au micromètre étalonné. Une électrophorèse sur gel d'amidon a été pratiquée sur 23 locus enzymatiques dont 9 se sont révélés polymorphes. Un traitement informatique des données a permis de calculer les distances biométriques (x^2 euclidienne) et une distance génétique (Ĭ de NEI) entre l'ensemble des 24 populations, d'effectuer des épreuves de classification automatique et de réaliser des diagrammes d'analyse factorielle des correspondances.

La lecture du dendrogramme obtenu à partir de l'étude biométrique permet de diviser l'ensemble des colonies en six groupes de taille inégale (fig. 2) ; la partition réalisée rend compte de 55% de la variance totale. La plupart des regroupements sont satisfaisants à un point de vue écogéographique. Ces résultats sont bien visualisés sur le plan principal de l'AFC (fig. 3) ; celui-ci rend compte seulement de 46% de l'inertie totale, ce qui est assez peu. Cependant, on relève quelques aspects paradoxaux, comme l'isolement dans le dendrogramme et sur le diagramme d'AFC de la population très centrale de la forêt de Mélan et le regroupement de la vallée de la Lance (haut Verdon) avec le Nord du Briançonnais.

Le dendrogramme électrophorétique suggère cinq groupements (fig. 4) dont la cohérence géographique est évidente ; la partition rend compte de 81% de la variance. L'AFC confirme la classification précédente, avec quatre groupes bien individualisés selon les deux premiers axes (qui représentent 71,3% de l'inertie totale) (fig. 5).

La comparaison entre le coefficient d'aplatissement moyen des mesures biométriques, qui donne une idée de la variabilité absolue de celles-ci, et du taux d'hétérozygotie, qui est tiré des données électrophorétiques et renseigne sur la diversité génétique des populations, est particulièrement intéressante (fig. 6). Elle montre une corrélation très significative entre les deux types de données.

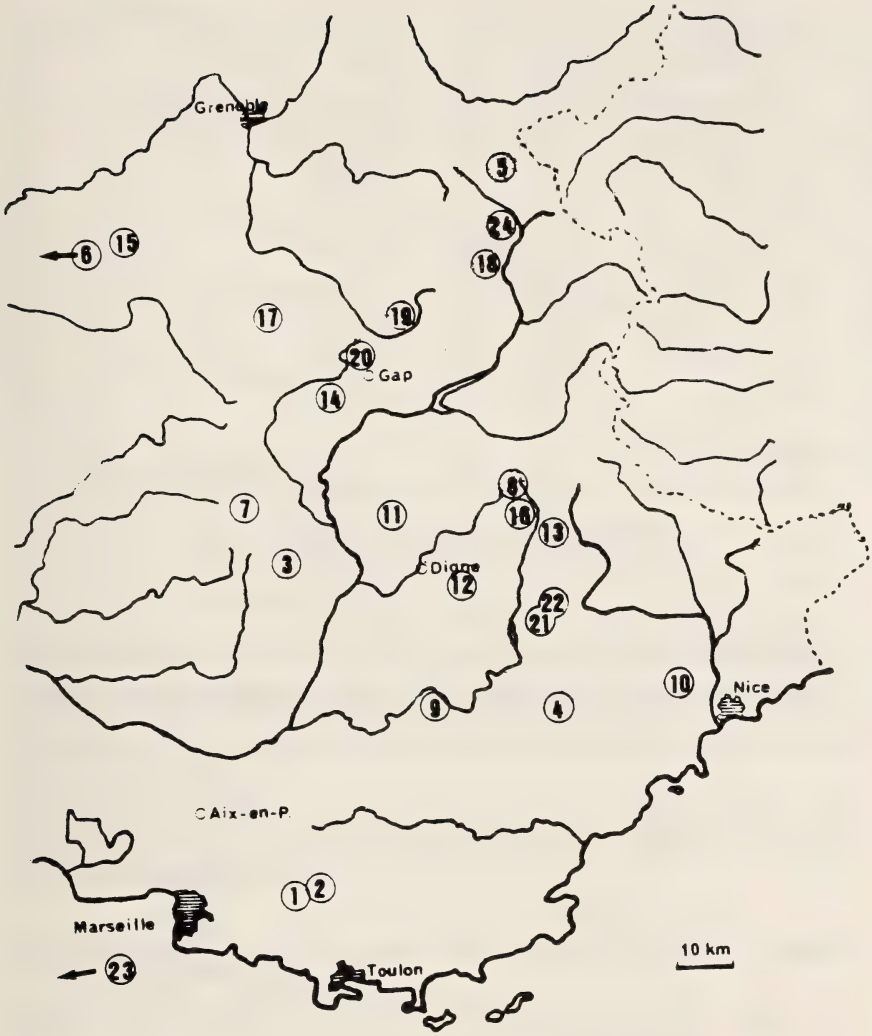

Fig. 1. Localisation des prélèvements. 1. Sainte Baume Ouest ; 2. id., Est ; 3. Montagne de Lure ; 4. Mgne de La Chens ; 5. Névache ; 6. forêt de Bonnefoy (Ardèche) ; 7. Mgne de Chamouse ; 8. la Foux d'Allos ; 9. gorges du Verdon ; 10. col de Vence ; 11. forêt de Mélan ; 12. les Dourbes ; 13. vallée de la Lance ; 14. Mgne de Céuze ; 15. col de la Bataille ; 16. sommet de l'Autapie ; 17. Lus la Croix Haute ; 18. Puy Saint Vincent ; 19. les Infournas ; 20. col de Gleize ; 21. Mgne de Chamatte ; 22. Montagnone ; 23. val de Galbe (Pyrénées Orientales) ; 24. les Combes.

Biométrie

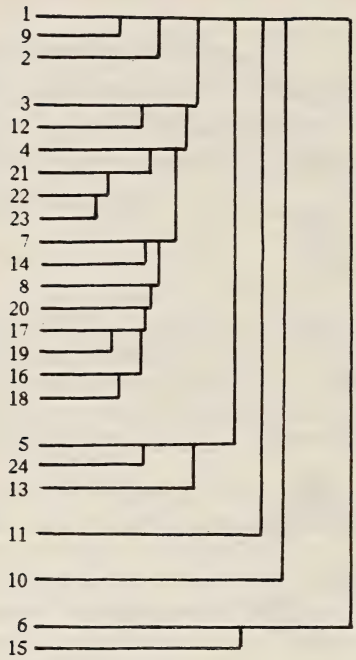

Fig. 2. Dendrogramme (dist. du x^2).

Électrophorèse

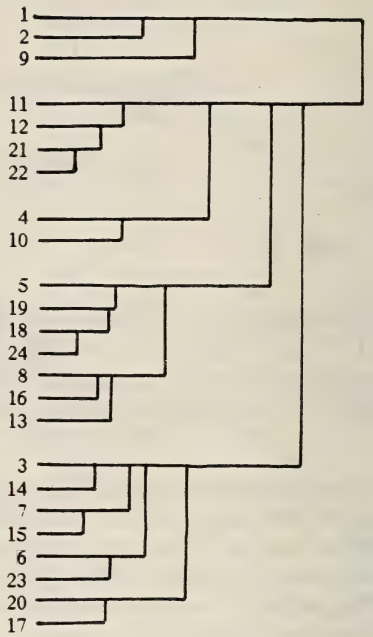

Fig. 4. Dendrogramme (dist. de Nei).

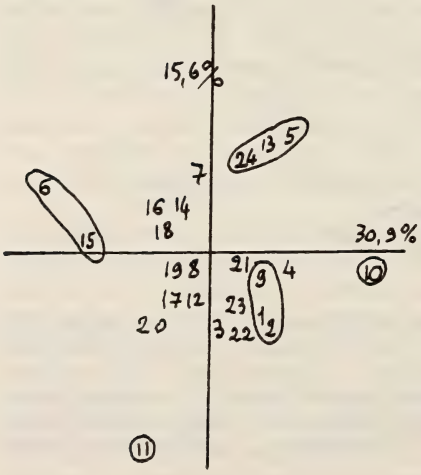

Fig. 3. Analyse factorielle des correspondances.

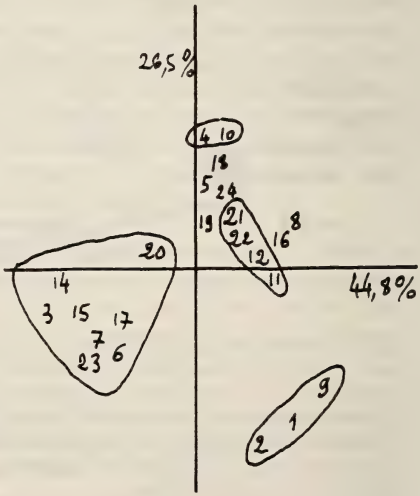

Fig. 5. AFC.

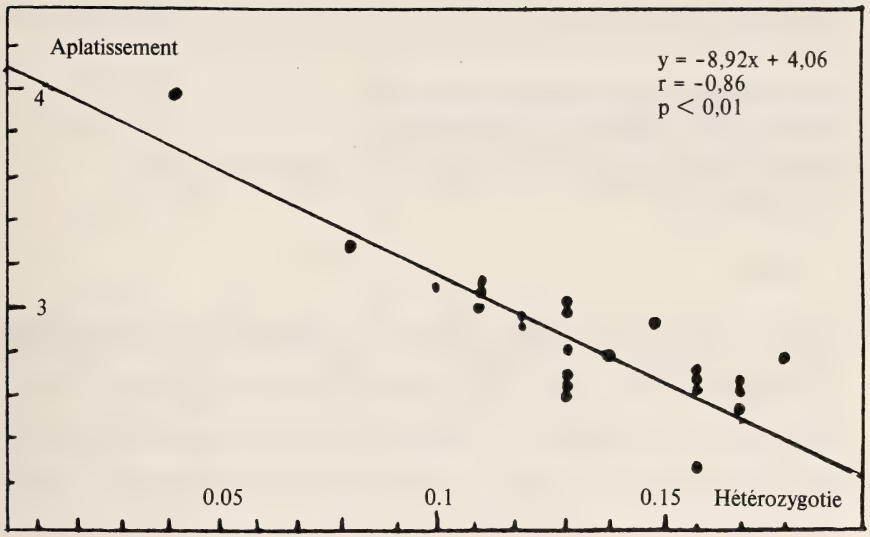

Fig. 6. Régression linéaire de l'aplatissement moyen des mesures biométriques contre le taux d'hétérozygotie.

Une coïncidence partielle peut être observée entre les deux classifications (en particulier dans le regroupement de la Sainte Baume et du Verdon). La classification électrophorétique permet de dégager des ensembles particulièrement cohérents. Les données électrophorétiques «répondent» bien mieux aux méthodes d'analyses que les données biométriques.

Particulièrement frappante nous paraît être la diminution corrélée des deux mesures, phénotypique et génotypique, de la diversité. Elle touche les populations à la mesure de leur isolement géographique.

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An attempt at a numerical model of the phylogenetical relationship between the genera of the tribe Gnorimoschemini (Gelechiidae)

D. Povolný

In view of the inherent difficulty in discerning apomorphic from plesiomorphic characters on the specific and generic level of the gelechioid tribe Gnorimoschemini, an attempt was made to interpret the phylogenetic relationships between 44 genera of this tribe. For this purpose 127 characters of the male and 42 characters of the female genitalia were analysed, and a five step gradient was elaborated to characterize the forewing pattern. In such a way a primary matrix was constructed, whereby the number of specific taxa belonging to the individual genera was also considered. As similarity functions, the Jaccard-index for binary data and Wishart-index for quantitative data were used. The above character complexes were classified both as weighted and unweighted data. For the cluster method of the hierarchic classification unweighted mean values were used and for non-hierarchic classification polar ordination was applied. The most sucessful classification was then transformed into a three dimensional idealized model of possible natural relationships of the treated genera. Despite the obvious methodological difficulties of numerical taxonomy, the proposed model of the relationships between the treated genera revealed a considerable coincidence of results when compared with our purely empirical knowledge of those relationships. This indicates that numerical taxonomy may positively contribute to the phylogenetic interpretations of relationships between taxa in situations where cladistic methods cannot be applied, due to the virtual impossibility to recognize the quality of characters studied.

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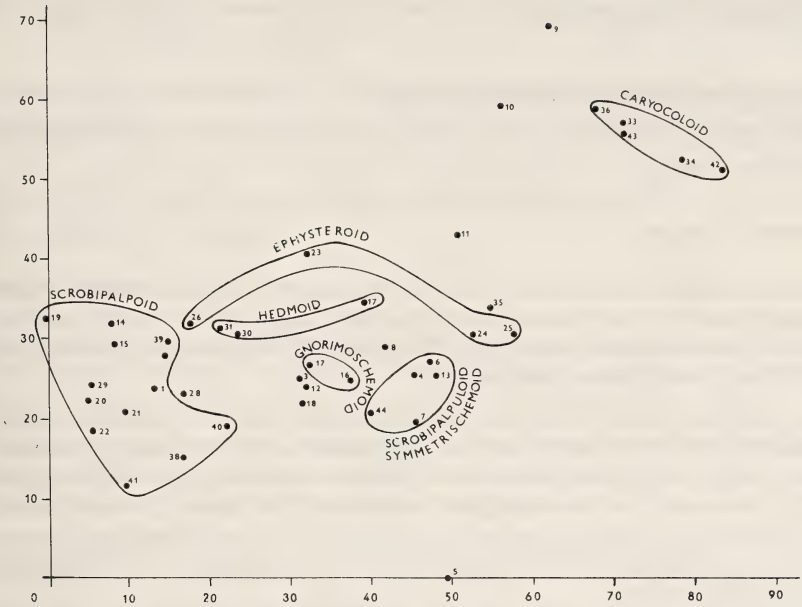

Fig. 1. Polarordination of gnorimoschemine genera (black dots with numbers from 1-44) whereby the pairs of genera *Euscrobipalpa-Caryocolum* and *Scrobipalpa-Keiferia* were used as ordination poles. (Results of the Wishart Index application with primary data standardized in percent).

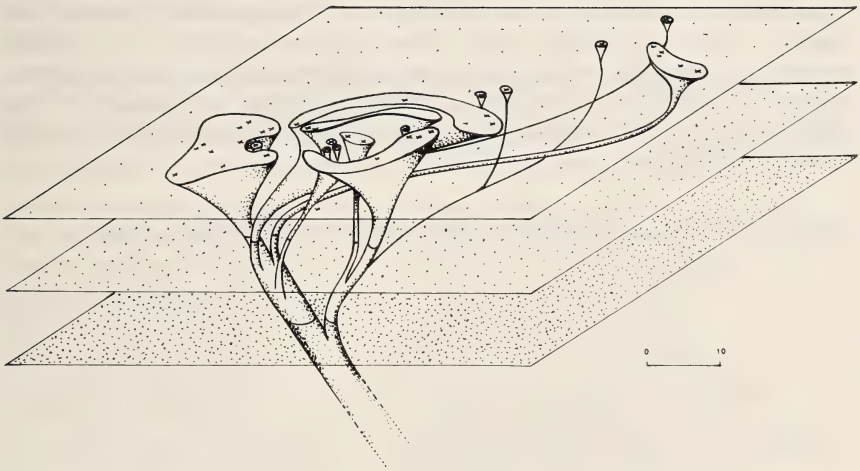

Fig. 2. Proposal of a tridimensional presentation of the phylogenetic relations within the tribe Gnorimoschemini based on previous polarordination. For details see Povolný & Šustek in 'Festschrift zum 85. Geburtstag von Dr. Josef Klimesch', Linz, 1988 (*Stapfia* 16 : 209-247).

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Micropterigidae in fossil resins with special emphasis on the past and present distribution of this family

Andrzej W. Skalski

Micropterigidae constitute nearly 2% of all lepidopterous inclusions of fossil resins ranging in age from the Cretaceous to the Tertiary. Remains of these moths fossilized in other conditions are extremely rare. The majority of the micropterigid fossils have been found in the Eocene Baltic amber.

The systematic status of the fossil Micropterigidae from the Mesozoic remains unclear. In the Baltic amber there are representatives of both main phylogenetic lineages of the family, the so-called *Micropterix* and *Sabatinca* groups of genera. The first is represented by the recent genus *Micropterix*. The second by extinct genera, and species similar in many aspects of morphology to the South American *Hypomartyria micropteroides* and other members of the *Sabatinca* group occurring in the Southern Hemisphere.

The genus *Micropterix* occurs primarily in the West Palaearctic where about 70 species have been described, whereas in the East Palaearctic only 1 or 2 species are recorded. The *Sabatinca* group consisting of 8 genera, has a largely circum-Pacific distribution and also occurs on the Cape of South Africa. Fossil records and present distribution of the Micropterigidae support the theory that its main lineages originated on the Laurasia paleaocontinent prior to the separation of several land masses or during a geological period when the continents were still in close proximity, a situation prevailing in early and mid-Mesozoic. The genus *Micropterix* became well established in the West Palaearctic, whereas the ancestors of the *Sabatinca* group which inhabited this region during the Tertiary became extinct during the Pleistocene.

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Faunistics and biogeography – Faunistik und Biogeographie – Faune et biogéographie

The Tortricidae fauna of the nature reserve park 'La Albufera' (Spain)

Joaquin Baixeras ALMELA

The 'La Albufera' nature reserve park is one of the most interesting marshy areas of the Iberian Peninsula. Recently protected by law, this park includes a littoral forest, 'El Saler', and the lake of 'La Albufera' that gives the park its name.

This interesting area has unfortunately suffered from human activities ; the water has become polluted and land was lost to urban developments in the 1960's. These have now been stopped, but their effects can still be observed.

The insect fauna is clearly one of the most important biological aspects of the area, but unfortunately we cannot assess the impact of these environmental changes since, perhaps with the exception of the Coleoptera and Hemiptera, there are very few old records. Several reports have focused on the Lepidoptera and perhaps the best known family may be the Noctuidae, of which 91 species have been recorded. Several are very rare in the Iberian Peninsular, such as *Brithys crini* (F.), *Mythimna straminea* (TR.), *M. umbrigera* (SAALM) and *M. joannisi* (BOURSIN & RUNGS). Moreover the Lymantriid and Cossid moths *Laelia coenosa* (HB.) and *Phragmataecia castaneae* (HB.) are known to have large populations in the marshy areas of the zone.

Very little data on the Microlepidoptera fauna is available, and the main aim of this paper is to present the more interesting Tortricidae of the area. So far 32 species have been recorded from the park, the majority coming from a sample of nearly 1300 specimens taken in a light trap run there in 1983 and 1984. The species are :

Trachysmia simoniana (STGR.)
Stenodes hilarana (H.-S.)
Stenodes cultana (LED.)
Phalonidia contractana (ZELL.)
Aethes languidana (MN.)
Aethes bilbaensis (ROESSL.)
Cochylidia heydeniana (H.-S.)
Cochylis posterana (ZELL.)
Xerocnephasia rigana (SODOFF.)
Cacoecimorpha pronubana (HB.)
Lozotaenia cupidinana (STGR.)
Clepsis pallidana (F.)
Clepsis consimilana (HB.)
Lobesia bicinctana (DUP.)
Ancylis sparulana (STGR.)
Crocidosema plebejana (ZELL.)
Epinotia thapsiana (ZELL.)
Acroclita subsequana (H.-S.)
Gypsonoma minutana (HB.)
Gypsonomoides trochilanus (FROEL.)
Eucosma expallidana (HAW.)
Eucosma maritima (WEST. & HUMPHR.)
Eucosma conterminana (H.-S.)
Rhyacionia buoliana (D. & S.)
Rhyacionia maritimana (PROESE)
Clavigesta sylvestrana (CURT.)

Bactra venosana (ZELL.)
Bactra bactrana (KENN.)
Bactra robustana (CHRIS.)
Cydia ulicetana (HAW.)
Cydia fagiglandana (ZELL.)
Cydia amplana (HB.)

Some of these species, e.g. *C. consimilana, B. venosana, C. plebejana* and *E. conterminana* probably originated from crops nearby. However, others are more interesting, being characters of salt marshes and littoral zones : *A. subsequana, E. expallidana* and *E. maritima. T. simoniana* and *A. sparulana* are both scarce Iberian endemics, the latter with a large population at La Albufera. *B. robustana* is new to the Iberian Peninsular, and the recently described *R. maritima* seems to be a rare Mediterranean species.

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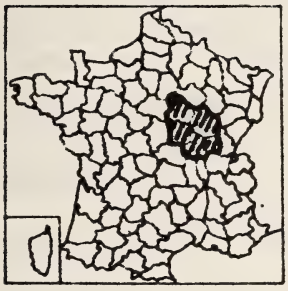
Utilisation d'un inventaire cartographique et de ses délimitations en régions entomofaunistiques. Le cas des Hesperioidea et Papilionoidea de la Bourgogne (France)

Cl. Dutreix

La partie méthodologique est développée en détail dans une thèse, soutenue en 1986 et éditée en 1988. Signalons succinctement que l'atlas cartographique des espèces est établi d'après un carré UTM – carroyage Universal Transverse Mercator – de 10 km de côté comme unité de situation opérationnelle. Sa mise à jour permanente jusqu'en mars 1988 prend ainsi en compte l'intégralité des observations de R. Essayan et de l'auteur durant la période 1976-1987. D'autre part, la visualisation de l'affinité entomofaunistique a été possible par un travail considérable d'analyse statistique multidimensionnelle (analyse factorielle des correspondances et classification automatique). Pour ces cartes synthétiques, deux sorties graphiques sont ainsi proposées, grâce à l'utilisation des méthodes statistiques sans et avec la contrainte de contiguïté spatiale, pour définir des unités et des secteurs «entomogéographiques».

Cet objectif atteint, nous bénéficions désormais d'un acquis appréciable pour aborder certains aspects de la «biogéographie appliquée». Dans l'établissement de la liste des «espèces menacées», il s'est avéré rapidement que la création d'un indice spécial était superfétatoire. Nous avons donc commencé par effectuer l'inventaire des espèces qui ne semblent pas menacées à court terme, puis le classement de celles qui peuvent être directement menacées, sur la base des statuts de l'UICN. Ainsi, les «espèces menacées» sont évaluées pour les 128 taxons à environ 23%, réparties de la manière suivante :



*	en danger d'extinction :	2 (1,56%)
**	vulnérables :	8 (6,25%)
***	rares :	19 (14,84%)
-	statut indéterminé :	8 (6,25%)
	(espèces acclimatées, signalées avant 1950, en limite de leur aire de répartition)	
-	«hors danger»	(6)
	(législation nationale en vigueur pour la protection partielle ou totale des espèces)	

Il convient donc de s'interroger sur les raisons de la rareté de ces espèces afin de distinguer des données objectives de leur déclin (raréfaction/disparition).

Nous envisageons différentes causes :

1. Hyperlocalisation des plantes nourricières (biotopes restreints) :
   ** *Satyrium w-album* KNOCH, ** *Cupido osiris* MEIG., ** *Maculinea* (*alcon*) *alcon* D. & S., *** *Maculinea* (*alcon*) *rebeli* HIRSCHKE, *** *Polyommatus thersites* CANT., * *Boloria aquilonaris* STICH., ** *Coenonympha tullia* MÜLL.

2. Facteurs – vraisemblablement – d'origine naturelle (modifications climatiques, ...) :
   *** *Pontia daplidice* L., * *Coenonympha hero* L., ** *Hipparchia statilinus* HFN., ** *Chazara briseis* L.

3. Facteurs anthropiques (circulation routière, essences non indigènes, ...) :
   ** *Limenitis populi* L.

4. Espèces localisées qui ont toujours été probablement rares (sensibles aux modifications de biotopes et aux récoltes abusives) :
   *** *Carcharodus flocciferus* Z., *** *Pyrgus alveus* HB., *** *Pyrgus* (*carlinae*) *cirsii* RBR., *** *Pyrgus carthami* HB., *** *Euchloe* (*ausonia*) *crameri* BUTLER, *** *Satyrium spini* D. & S., *** *Satyrium acaciae* F., *** *Heodes alciphron* ROTT., *** *Palaeochrysophanus hippothoe* L., *** *Lampides boeticus* L., *** *Pseudophilotes baton* Bergstr., *** *Plebejus argus* L., ** *Polyommatus dorylas* D. & S., *** *Fabriciana niobe* L., *** *Euphydryas maturna* L., *** *Mellicta parthenoides* KEF., *** *Lopinga achine* SCOP.

Référence

DUTREIX, Claude, 1988. Le peuplement des Lépidoptères de la Bourgogne (Hesperioidea, Papilionoidea). Société d'Histoire naturelle et des amis du Muséum d'Autun, éd., 277 pp.

Adresse de l'auteur : SHN Autun, 15 rue Saint-Antoine, F-71400 Autun, France.

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Biogéographie de *Graellsia isabelae* GRAELLS (Saturniidae)

Albert MASÓ I PLANAS et Pierre WILLIEN

Adaptation au milieu

G. isabelae est une espèce adaptée à un milieu très concret. Les conditions optimales d'émergence de l'imago sont : de 20 à 25°C, de 70 à 80 p. 100 d'humidité. Celles-ci se produisent au printemps dans les écosystèmes où on la rencontre. L'imago vole de la fin mars au début du mois de juillet, avec une densité optimale de vol en mai, encore qu'au nord des Pyrénées elle puisse avoir lieu en juin. Les ♀ émettent des phéromones, mais les ♂ se montrent lorsque la température est supérieure à 13°C et l'humidité inférieure à 80 p. 100. Ce minimum thermique est inférieur à la normale chez les insectes, ce qui lui permet de s'adapter aux milieux froids (durant les nuits de printemps) où croissent les forêts d'arbres dont se nourissent les chenilles : *Pinus sylvestris* et *P. nigra.* La chrysalide hiberne (la température optimale de mortalité minimale se situant entre 8 et 12°C).

Écologie

Contrairement à ce qui a été affirmé, l'altitude minimale où puisse vivre l'espèce n'augmente pas à mesure que diminue la latitude. Cette confusion provient sans doute de la rareté des citations la concernant. Maintenant que nous connaissons mieux sa biogéographie, nous sommes en mesure d'affirmer qu'elle manifeste tout simplement une nette préférence pour le climat continental et, surtout, qu'elle suit les forêts des deux conifères mentionnés plus haut.

Il n'est pas plus exact, tel que cela a été publié, qu'elle ne puisse vivre en dessous de 1000 m. S'il est des zones où elle n'apparaît pas, c'est uniquement dû au fait que ces dernières n'abritent aucun des deux pins en question, ou que l'espèce n'y est pas encore arrivée. L'altitude et autres facteurs n'y sont donc pour rien, puisqu'en Catalogne elle a été capturée à 215 m (Garrotxa), 200 m (Empordà), 170 m (Banyoles) et même 95 m (Cornellà del Terri, Gironès). Ce qui est certain, en revanche, c'est qu'elle évite le littoral.

Répartition

Limitée à la péninsule ibérique et au sud-est de la France, elle constitue 8 populations au total :

2 en France :

– au nord du Massif central, il y a quelques références, mais on ne peut pas considérer qu'il y existe une population.

– dans le Jura (Ain), presque touchant l'ouest de la Suisse.
– Hautes-Alpes, longeant la frontière franco-italienne. Il s'agit de la population la mieux établie et la plus étendue de la France, parvenant jusque dans les Alpes-Maritimes.

2 dans les Pyrénées :
– occidentales : nord-est du Pays basque (Navarre) et moitié septentrionale de la province de Huesca.
– orientales : centre et nord de la Catalogne, jusqu'au versant français (Vallespir et haute Cerdagne). C'est la zone la plus vaste et où l'espèce s'est le mieux adaptée : elle a été rencontrée dans 86 localités.

4 dans la péninsule ibérique :
– cols de Caro, à proximité du delta de l'Ebre. C'est la population la moins abondante de la péninsule.
– sierras de Albarracín, Javalambre, Gudar, Penyagolosa, montes Universales et serranía de Cuenca (provinces de Teruel, Cuenca et Castellon).
– sierra de Guadarrama, à l'ouest de la province de Madrid et régions limitrophes. C'est la seule population qui ne puisse se nourrir que de *P. sylvestris.*
– sierras de Cazorla et Segura, dans la province de Jaén, la seule où il n'existe que des forêts de *P. nigra.*

Isolement géographique

Les populations françaises sont nettement séparées les unes des autres, ce qui ne semble pas être le cas de toutes celles de la péninsule ibérique. Cependant, le fait qu'elles aient toujours été considérées comme telles a entraîné la description de diverses sous-espèces, dont pas une seule, à nos yeux, n'est suffisamment prouvée. En ce qui concerne les zones de Jaén et Guadarrama, la séparation est nette, même s'il existe dans la province de Ségovie des forêts de *P. nigra* s'étendant jusqu'à Teruel-Cuenca. À son tour, cette dernière population pourrait être rattachée à la minuscule population des cols de Caro et ce, par les montagnes du Maestrat, concrètement par les cols de Morella, où l'on rencontre des forêts de *P. sylvestris* et même de *P. nigra.* Cette zone de Caro est incontestablement limité au nord par le Bassin de l'Ebre, étant donné qu'il existe de part et d'autre du fleuve une vaste étendue totalement dépourvue de pins.

La connexion la plus évidente à nos yeux est celle des Pyrénées. Traditionellement, on supposait que la frange de séparation entre la population occidentale et la population orientale occupait tout le nord de la province de Lérida, de Huesca à l'est d'Andorre. Cependant, à l'heure qu'il est, grâce aux spécimens que nous avons récoltés, nous pouvons prouver que la population orientale s'étend plus à l'ouest (elle vit dans la région ouest de l'Andorre) ; nous l'avons rencontrée, en particulier, à Jou, au centre de la prétendue frange de séparation, ce qui nous entraîne à affirmer que cette dernière est circonscrite à l'espace transversal que détermine le val d'Aran. De futures prospections confirmeront ou non cette hypothèse selon laquelle les deux

populations des Pyrénées se confondent et ne forment qu'une seule aire très étendue. Il faut tenir compte du fait que les deux conifères précités se rencontrent d'un bout à l'autre du territoire.

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Past and present studies on the Mongolian Lepidoptera fauna

L. Peregovits

From the mid 19th century to the first three decades of the 20th century, collecting in Mongolia was restricted mostly to expeditions which had as their main interest China, Tibet or southern Siberia. These expeditions usually crossed the present territory of Mongolia via the Great Lakes Basin or Ulaan-Baator (Urga).

Although the territory was poorly explored, some well-known collectors of this period (e.g. Lederer, Avinov, Groum-Grshimailo) collected here. The material collected was studied by Staudinger, Alphéraky and Groum-Grshimailo, and several papers were published at the end of the 19th century. For a long period, these papers had been the only source for scientists interested in the Lepidoptera of this part of the Palaearctic region.

Entomological collecting activity increased again at the beginning of the 1960's. Most of these expeditions were organised and led by entomologists, although only a few lepidopterists were involved. This meant that the collecting of Lepidoptera was only of secondary interest, and was usually restricted to the butterflies. It should be mentioned that the late Z. Kaszab, former General Director of the Hungarian Natural History Museum, collected an enormous amount of insect material, including some 41,000 Lepidoptera. Though some papers were published in the series "Insects of Mongolia" (Science Press, Leningrad), the Lepidoptera material collected by the Mongol-Soviet joint biological expeditions has not yet been fully investigated. As far as I know, the majority of the material is deposited between layers of cotton-wool at the Zoological Institute in Leningrad awaiting pinning and labelling. Of course there were several other less extensive collecting trips, most of which received little attention, or the results of which were not published.

In 1986, 1987 and 1988, there were four Hungarian lepidopterological expeditions to Mongolia. The participants, apart from the author and M. Hreblay, were G. Fábián and G. Ronkay in 1986, A. Orosz and T. Stéger in 1987, and Z. Varga in 1988. The fourth expedition was undertaken by P. Gyulai and Z. Varga in 1986. Their trip took place at about the same time as that mentioned above, but the route was different (Fig. 1). The aim of these expeditions was to sample the Lepidoptera fauna, with emphasis on the macrolepidoptera, using various methods. More than 50,000 "macros" were collected, the majority of which have already been identified. Further expeditions should concentrate on the rather poorly known desert and high mountain (alpine) habitats, which cover nearly 20% of the country.

Fig. 1. Vegetation map of Mongolia. 1. Alpine belt, 2. Montane taiga, 3. Montane forest steppe, 4. Tall grass steppe, 5. Short grass steppe, 6. Desert. Above : the routes taken by the various expeditions.

Although results on some groups (Diurna, Arctiidae and a few Noctuidae groups) have been published or are in print, our final aim is to summarize the findings in a book on the Mongolian Lepidoptera.

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The Macrolepidoptera fauna of the Eastern Carpathians : a multivariate study

L. Peregovits and J. Podani

Our knowledge of the macrolepidoptera fauna of the Eastern Carpathians is still insufficient. Only sparse data have been published and the localities investigated are unevenly distributed. The objective of the present study is to evaluate available data and materials by multivariate methods in order to show the influence of collecting intensity on biogeographical classification.

Material and methods

The present study utilizes checklists compiled by the first author during field trips to Transylvania from 1978-1984, published data, material deposited at the Zool. Dept. of the Hung. Nat. Hist. Mus., and private collections. The faunistic records were entered in a computer data base. A presence/absence matrix composed of 878 species and 137 localities was extracted from the data base. The number of species per locality ranged from 1 to 449, reflecting an extreme imbalance of sampling. Therefore, we decided to examine the effect of reducing the number of localities upon the result. In the first step, localities with less than 23 species were omitted, so that 54 localities and 869 species remained. In the subsequent steps the threshold was set to 60 and then to 90 species, yielding 30 localities with 850 species, and 18 localities with 833 species (Fig. 1), respectively. The three data matrices were subjected to clustering and principal co-ordinate analysis (PCoA), using programs NCLAS2 and PRINCOOR of the SYN-TAX III package written by the second author. The dissimilarity coefficient was the complement of Jaccard's index ; single and complete linkage methods were selected for clustering. PCoA was based on the same dissimilarity measure.

Results and discussion

Results of single linkage clustering exhibit chaining (therefore not presented here), an effect characterizing situations when no sharp clusters can be delimited. Only a few pairs or small clusters could be recognized. Complete linkage forced a group structure on the data (Fig. 2), and these groups are not always recognizable in single linkage and PCoA results (Fig. 3). The eigen-values associated with PCoA axes are very small and slowly increase, further suggesting that no clear-cut data structure exists. However, it is worthwile to examine how the positions of the 18 localities are influenced when additional localities are added to the analysis. Comparison of the three ordinates show that increase in sample size does not change the relationships

among the objects of the basic set. Numbers of species are important in determining these relationships, but closely related objects are often found together in the diagrams despite the great differences in their species number. A conclusion is that one must be very careful when interpreting biogeographical classifications, because differences in collecting intensity may obscure similarities between localities. Nevertheless, obvious biogeographical relationships remain visible even if differences in species number are great.

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Fig. 1. The distribution of the 137 collecting localities. The localities with less than 23 collected species are marked with dots, those with > 90 species with numbers 1-18, those with 60-89 species with numbers 19-30 and those with 23-59 species with numbers 31-54.

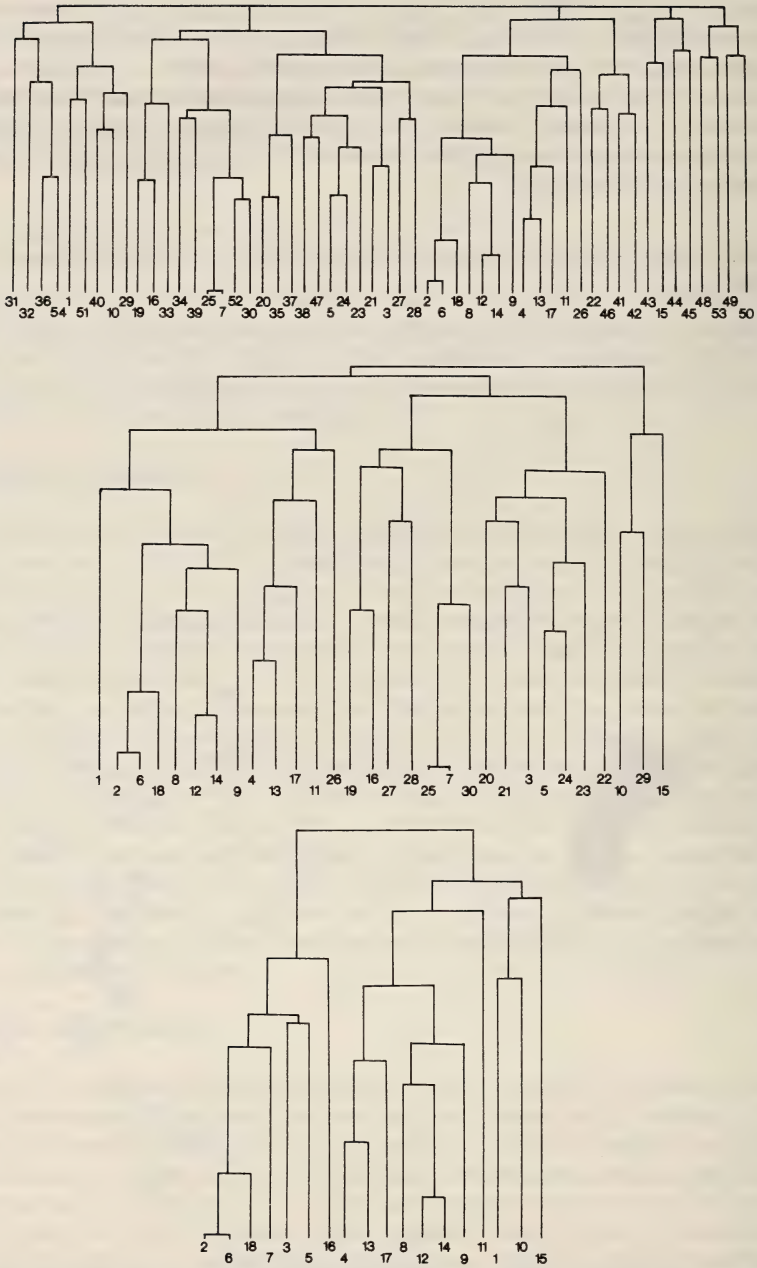

Fig. 2. The results of the complete linkage cluster analysis of 18, 30, and 54 localities, respectively (for explanation see Fig. 1).

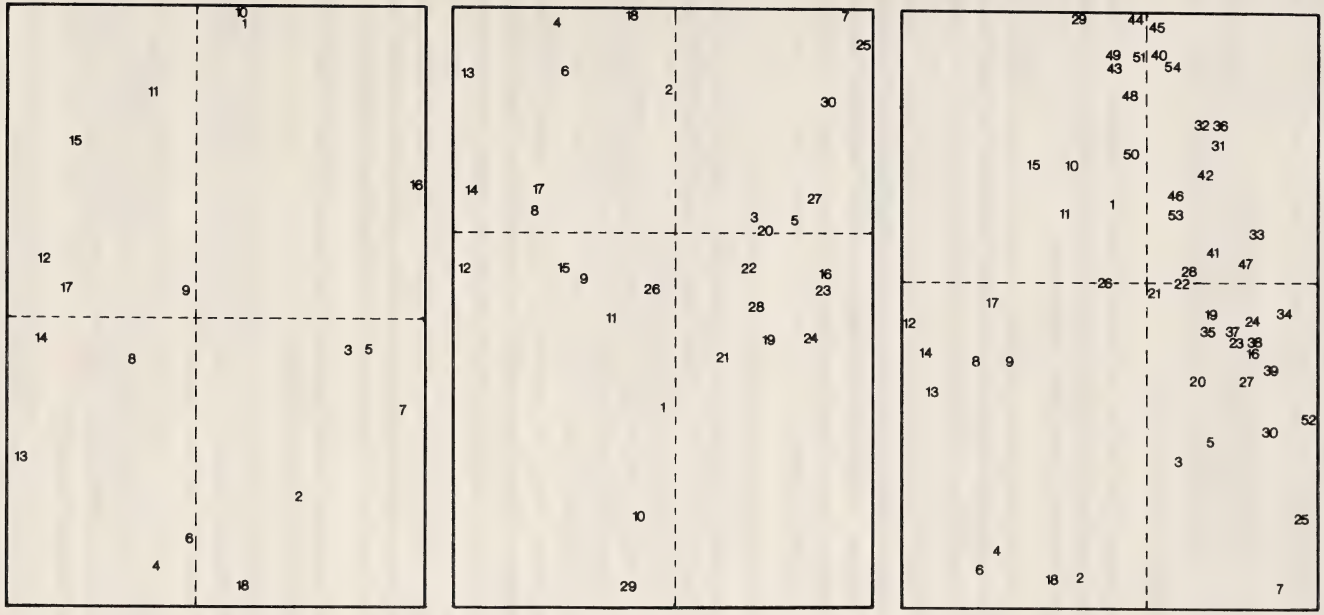

Fig. 3. The results of the PCoA of 18, 30 and 54 localities, respectively (for explanation see Fig. 1).

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Geographical distribution of Lepidoptera in the Italian peninsula : A numerical analysis (*)

Tommaso RACHELI & Alberto ZILLI

An overall biogeographical survey of Italian Macrolepidoptera has never been undertaken. None the less, our actual knowledge of taxonomy and distribution of many Lepidopterous taxa is more than satisfactory.

The similarity index for binary data proposed by BARONI-URBANI & BUSER has been used to ascertain the faunal relationships between areas on the basis of studies on Papilionoidea, Hesperioidea and Noctuidae, comprising a total of 951 species.

A data matrix of the 951 taxa according to their presence/absence in 13 regions was set down. The regions were arranged not as strictly political units, but lumped into more "natural" regions. As faunistic data were poor for Campania, the presence of many species likely to occur there were added. Corsica, Sardinia and Sicily have been excluded from the analysis.

A single-link cluster analysis gave the following results :

(1) The cluster relative to Noctuidae + Papilionoidea + Hesperioidea exhibits a high degree of similarity at 0.75, differentiating however three subclusters which identify the Alps, the Apennines and Liguria ;
(2) The cluster relevant to Noctuidae (714 species) shows a difference for Toscana due to a probable underestimation of the data, while Piemonte + Val d'Aosta is significantly removed from the Alps ;
(3) The Hesperioidea, being few species (30), give no general information, displaying however a high homogeneity in the distribution due to the relatively high incidence of euriecious species which are spread over large territorial zones ;
(4) The cluster for Papilionoidea, comprising 207 species, exhibits four main subclusters, one centred in Piemonte and the others representing the central-eastern Alps, northern Apennines and central-southern Apennines.

The main result emerging from the present analysis is the high degree of faunistic similarity between all the regions studied.

The data obtained with quantitative methods reflect the actual scenario without considering the species qualitatively ; each have different population dynamics, and are distributed according to their unique history.

The high number of species used in the present analysis is suggestive of a "true" homogeneity of the Macrolepidoptera in the Italian peninsula, with small geographical differences from North to South where the Apennines have played and still play a major role in faunistic balancing.

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Les Lépidoptères et la végétation dans la zone sommitale du massif du Crêt de la Neige (Ain, France)

P. Réal

Notre collègue J. F. Prost a inventorié environ 470 plantes supérieures dans la zone sommitale du Crêt de la Neige. Nous pouvons faire état d'environ 560 Lépidoptères (dont 406 «Macro»).

Plantes et Lépidoptères ont subi les mêmes vicissitudes dès avant l'ère tertiaire jusqu'à aujourd'hui. Cependant le spectre biogéographique des deux ensembles est très différent. Notre communication ne portera que sur les «Macrolépidoptères».

Chez les plantes, 30% sont endémiques européennes, contre 2,2% chez les Lépidoptères. On pourrait admettre que la qualité «européenne» est une variante de l'ensemble du fonds commun eurasiatique dont le total chez les plantes atteindrait alors 57%. Chez les Lépidoptères, 63% des espèces sont de ce type.

Les grandes différences s'observent dans les proportions des sphères froides (alpine, boréoalpine, hygroholarctique) et chaudes (diverses méditerranéennes, sarmatiques) qui constituent respectivement chez les plantes 31 et 7% des espèces, et chez les Lépidoptères 17 et 18%. Cette situation provient de ce que les Lépidoptères qui sont mobiles ont abandonné le Crêt de la Neige lors du réchauffement postwürmien tandis que les plantes tendaient à rester sur place, avec un faible apport méridional. D'où une modification partielle de l'allure de la faune, et une adaptation progressive aux plantes locales.

Il aurait été intéressant de s'attarder aux différences d'ordre systématique. On se bornera à ce qui suit. Les Lépidoptères ont de grandes familles cosmopolites, Noctuides (ici 22%), Géométrides (ici 26%) ; la plus grande famille botanique, les Composées, est limitée à 12%, les Graminées à 9%, les Papilionacées à 5%, les Rosacées à 4,5% etc. Là encore il est évident que le rôle des diverses familles comme supports ne sera pas en rapport avec le % d'espèces.

Nous avons tenté, à partir d'un fichier plantes-hôtes/Lépidoptères, d'évaluer la liaison. Il en est sorti que la mobilité des chenilles dans l'intérieur d'une famille botanique est l'apanage de 27% des espèces, et d'une famille à l'autre, de 30,5%, à l'échelle française. Cependant sur le total de nos captures en zone altitudinale, plus de 300 espèces dépendent d'une seule famille.

En considérant les espèces qui habiteraient les plantes rencontrées et les espèces voisines sur lesquelles une adaptation est très probable, nous avons chiffré une faune virtuelle d'environ 1000 espèces. Le massif supporterait donc 1550 espèces et un gros travail reste à faire surtout chez les ex-«Micros».

Nous aboutissons enfin à classer les espèces en allant de la plus grande polyphagie à la stricte monophagie. La zone sommitale restreint un peu les données et certaines

espèces y sont probablement contraintes à la monophagie, sauf migration. Ce phénomène n'a pas une grande ampleur. 9% des espèces vivent sur au moins 4 familles botaniques : souvent on observe une pseudo-oligophagie de base, élargie ensuite. 10% d'espèces, surtout des Géométrides, vivent sur 3 familles.

16% vivent sur seulement 2 familles : 1/5 est pseudo-oligophage ; 1/4 choisit deux familles voisines du point de vue systématique, surtout Dialypétales ; 1/5 est centré sur les Ericacées ; d'autres autour de *Thymus serpyllum*, de Composées et de Dipsacacées.

315 «Macros» vivent sur une seule famille, sur un genre ou même une espèce (56 monophages). Nous ne pouvons, dans ce cadre, donner que quelques exemples : *Colias palaeno* L. vit sur *Vaccinium uliginosum*, *Eupithecia veratraria* H.-S. sur *Veratrum album*, *Minoa murinata* SCOP. sur *Euphorbia cyparissias*, *Zygaena fausta* L. sur *Coronilla vaginalis*, *Apamea platinea* TR. sur *Hippocrepis comosa*, *Adela fibulella* D. & S. sur *Veronica chamaedrys*, *Euphya frustata* TR. sur *Galium verum*, *Pterophorus nephelodactylus* EVERSM. sur *Cirsium eriophorum* etc. Nombreux sont les exemples d'espèces ou de genres vivant sur un genre botanique.

Il paraît plus important de souligner un fait qui ne semble pas avoir été remarqué, tant à l'échelle générale (par ex. la France), que locale : il existe beaucoup plus d'espèces (25%) vivant sur des Composées, que l'importance numérique de cette famille ne permet de le supposer (12%). À l'échelle française, on remarque de même que des familles très évoluées se comportent ainsi : plus de 45% des *Cochylidae*, plus de 42% des *Pterophoridae*. Le phénomène s'accentue avec le degré d'évolution du groupe de Lépidoptères. On recherchera ce phénomène, ses modalités et ses causes chez d'autres familles botaniques très évoluées.

Les relations des Lépidoptères avec leurs plantes-hôtes sont très complexes. Encore n'a-t-on pas évoqué ce qui se passe chez les ex «Micros» et apparentés, ni les modes de nutrition, dont celui des imagines.

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Les Lépidoptères alpins et méditerranéens du massif du Crêt de la Neige (Ain, France)

P. Réal

Le Crêt de la Neige (1723 m) est le plus haut sommet du Jura, situé très au sud, mais il n'a l'horizon barré que sur 135° d'angle, principalement au sud par le Vercors et la Chartreuse (à env. 160 km) et dans le quadrant SE par les Alpes, Revard, Bauges, monts d'Annecy (à env. 50 km) puis par les Alpes cristallines (Reposoir et Dent du Misi, à 60 km). Il en résulte qu'il constitue un promontoire avec vue libre sur 225%.

La flore et la faune qui l'habitent illustrent cette particularité. Nous avons fait une série d'expéditions sur ce terrain difficile d'accès et avons par nos récoltes et quelques compléments de la littérature recensé plus de 550 espèces, dont 405 Macrolépidoptères dont la biogéographie est assez connue pour permettre des conclusions assez sûres. Il semble qu'antérieurement moins de 180 espèces aient été signalées au dessus de la forêt, en général, de 1350 à 1450 m, jusqu'aux sommets.

Dans la littérature, surtout helvétique, les sphères biogéographiques sont peu ou pas définies ; nous avons dû écarter, en principe, du sujet qui nous intéresse, de nombreuses espèces qui ne sont que des eurasiatiques orophiles, et faire le départ entre les méditerranéomontagnardes et les alpines ; en outre il faut distinguer entre alpines, boréoalpines, hygroholarctiques d'une part, méditerranéoasiatiques, atlantoméditerranéennes et parfois tyrrhéniennes, ou pontosarmatiques d'autre part. Les résultats sont les suivants.

1. Macrolépidoptères alpins, 20 dont 18 connus dans la littérature ; celle-ci contient de plus 9 espèces dont 3 sont les célèbres douteuses, *Oeneis glacialis* Moll., *Parnassius phoebus* F., *Colias phicomone* Esp. ; 11 autres ont été rayées à juste titre par J. F. Aubert.
2. Boréoalpins : 18 dont 8 connues dans la littérature qui mentionne 2 espèces à rayer de la liste jurassienne.
3. Hygroholarctiques : 4 espèces dont 3 déjà citées.
4. Méditerranéoasiatiques : 54 espèces dont 10 citées dans la littérature plus 11 autres citées qui n'atteignent peut-être pas les sommets.
5. Atlantoméditerranéens : 4 espèces plus 2 citées dans la litterature.
6. Méditerranéomontagnards : 14 dont 6 connus dans la littérature qui en cite encore deux autres.
7. Pontoméditerranéens : difficiles à définir, au moins 1 espèce.
8. Subtropicaux et plus ou moins cosmopolites : 3 (2 cités dans la littérature qui en cite 3 autres).

Autres Lépidoptères («Micros» etc.) : nous avons (les n° renvoient aux sphères ci-dessus) :

1 – 18 espèces dont 7 citées dans la littérature qui en indique 4 autres.
2 – 27 dont 10 dans la littérature où figurent 4 autres plus une à supprimer.
3 – 2 espèces, les autres holarctiques étant de zone tempérée (6 espèces).
4 – 28 espèces dont 2 dans la littérature où en figurent 8 autres.
6 – 6 espèces dont 3 dans la littérature.
7 – 1 espèce possible mais non déterminée avec certitude.
8 – 1 seule espèce (*Plutella xylostella* L.).

Un certain nombre d'espèces sont nouvelles pour le Jura :
Autographa aemula D. & S., alpin d'Eurasie, sur flancs E et W.
Entephria contestata VORBRDT., alpin, trouvé au Colomby de Gex.
Aricia artaxerxes F., très rare, au sommet du Crêt de la Neige.
Catoptria luctiferella HB., alpin, pris sous le Reculet.
Kessleria saxifragae STT., alpin, pris sous le Reculet.
Epinotia granitana H.-S., boréoalpin, dans les Conifères subsommitaux.
Rhyacia helvetina BSDV., méditerranéomontagnard pris sur le flanc E.
Scotopteryx vicinaria DUP., méditerranéomontagnard, pris sous le Reculet.
Diceratura roseofasciana MN., subsp. *leucanthana* CST. (S. du Reculet).

Nous devons signaler que quelques espèces mal connues, non encore retrouvées par nous, ont été découvertes pour la première fois en France dans le massif du Crêt de la Neige. Nous ne l'avons publié que pour *Blastotere laevigatella* H.-S. (trouvée depuis dans les Hautes-Alpes) ; ce sont aussi *Cataplectica silerinella* Z., *Caloptilia loriolella* FREY et *Stenoptilia lutescens* H.-S. (bona sp. ?).

Au total nous attirons l'attention sur 140 espèces, 46 appartenant aux sphères biogéographiques froides, 94 aux chaudes, la littérature essentielle citant seulement 33 espèces de la première série, 36 de la seconde. À noter que 11 espèces appartenant aux sphères froides, prétendument présentes dans le Jura, ont été rayées de la liste. Mais notre travail ne nous a permis de récolter à ce jour, selon nos évaluations, qu'environ 1/3 de ce qui peut exister dans ce massif, les Lépidoptères autres que les «Macros» requérant une nouvelle prospection importante.

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Zoographical survey of the Mongolian Noctuidae fauna

Z. VARGA, L. RONKAY and L. PEREGOVITS

The importance of investigating the Mongolian lepidopterous fauna is emphasized by the following points : 1. The boundaries of some major faunal types with antagonistic dynamics, some of which overlap, run through the country ; 2. It appears to be an important centre of diversification for some characteristic xeromontane and eremic genera. Our investigations were based on material consisting of more than 100,000 specimens collected mainly by Hungarian expeditions (see PEREGOVITS, this Supplement, p. 00).

The present fauna has been determined by the extreme continental climate, the varied orographical and edaphic conditions of the region, and historically by the effect of the great climatic fluctuations during the Pleistocene. The S. Siberian taiga, montane taiga, altoherbosa and the "arboreal derived tall grass" steppe faunas have been displaced by the non-arboreal faunas of xeromontane and eremial types. The contact zones of some W. and E. Palaearctic subspecies of some species (e.g. *Polia bombycina* HUFNAGEL) are to be found here.

Fig. 1. The distribution of a selection of species typical of their faunal types : **Manchurian arboreal** : *Hydraecia mongoliensis* URBAHN (large open triangle) ; **Siberian arboreal** : *Xestia sincera* H.-S. (filled diamond), *Polia vespertilio* DRAUDT (tall open triangle) ; **tundro-alpine** and **alpine** : *Xestia laetabilis pergratiosa* KOVÁCS and VARGA (filled circle), *Lasionycta leucocycla altaica* STGR (crossed circle), *Estimata herrichschaefferi* ALPHÉRAKY (inverted filled triangle).

Fig. 2. As Fig. 1. **Xeromontane** : *Dichagyris ignara* STGR (filled triangle), *Dichagyris kaszabi* VARGA (filled circle), *Rhyacia junonia schistochroa* KOVÁCS and VARGA (crossed circle), *Haderonia sukharevae* (inverted triangle) ; **eremial** : *Aleucanitis mongoliensis* WILTSHIRE (filled square), *Cardiestra gobideserti* VARGA (barred filled circle), *Hadula halodeserti* (VARGA (open square).

The two major groups of the oreal faunal types, the alpine s.l. (in this connection as "S. Siberian alpine"), and the xeromontane intergrade here. The distribution of the former has a clearly peripheric, scattered character, following the main ranges of the Mongolian Altai, Changaj, Chentei and Sajan mountains. During the pluvial phases of the Pleistocene, these mountains served as "stepping stone" corridors and/or filters for the tundral and S. Siberian alpine and arboreal faunal types. The xeromontane faunal elements of the Mongolian Noctuidae fauna have, on one hand, a more or less autochtonous character manifested by the presence of endemic taxa of some species-rich genera, e.g. *Dichagyris*, *Euxoa*, *Haderonia*, and on the other they show connections with some central Asiatic regions, especially Kurdistan, by the presence of numerous common, but stenochorous species, e.g. *Pseudohadena*, *Paleoagrotis*, *Dichagyris*, *Euxoa*, *Parexarnis*.

The desert/semi-desert areas, which served in the interpluvial stages as the main barriers for faunal movements of the region, presently provide habitats for many, mostly endemic or stenochorous, eremic species and subspecies (see Figs.).

Though physiognomically similar landscapes can be found not so far away (e.g. Turkestan, Tibet), it is striking that in cases of some genera and species groups, the number of vicariant taxa is high, especially compared with Turkestan.

Future studies will have to focus on the poorly known eremial and montane steppe faunas, e.g. the island-like exclaves of the Gobi Altai chain and the Hangay mountains.

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History of Lepidopterology – Geschichte der Lepidopterologie – Histoire de la lépidoptérologie

Soixante ans de lépidoptérologie italienne

Prof. Sergio BEER

Le rapporteur évoque les traits saillants du caractère et de l'activité des lépidoptérologues italiens disparus qu'il a connus personnellement : Emilio TURATI, Ruggiero VERITY, Ubaldo ROCCI, Attilio FIORI, Orazio QUERCI, Federico HARTIG, etc.

Cet exposé est précédé d'une introduction historique concernant l'apport des auteurs italiens au développement de la lépidoptérologie après la réforme linnéenne (œuvres de Leonardo DE PRUNNER, Giuseppe GENÉ, Vittore GHILIANI, Pietro ROSSI, Orazio COSTA, Luigi FAILLA TEALDI, Antonio CURO, Fortunato ROSTAGNO, Renato PERLINI, Mario MARIANI et autres) ; il est suivi d'un aperçu de l'activité des lépidoptérologues actuels et des perspectives ouvertes par les méthodes nouvelles d'étude et de vulgarisation (méthodes génétiques et biomoléculaires ; éco-ethologie comparée, cinéma et télévision, etc.). Il se termine par le tableau encourageant des liens étroits entre les membres de la «famille SEL», qui préfigure l'unité de l'Europe au-delà des frontières, des langues et des systèmes politiques, unité soutenue par une même passion pour les êtres les plus splendides et les moins bruyants de toute la nature vivante.

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The history of butterfly research in the Caucasus

Yuri P. NEKRUTENKO

The following entomologists have provided the greatest contribution to our knowledge of the butterfly fauna of the Caucasus. Full details will appear in my book "The butterflies of the Caucasus" (Vol. 1) under the title "The history of research : people, collections, publications".

E. MÉNÉTRIES (1802-1861), A. VON NORDMANN (1803-1866), F. A. KOLENATI (1812-1864), A. KINDERMANN (1810-1860), J. HABERHAUER (1828-1902), J. LEDERER (1821-1870), O. STAUDINGER (1830-1900), S. ALPHERAKY (1850-1918), H. CHRISTOPH (1831-1894), N. N. SHAVROV (1858-?), G. RADDE (1831-1903), L. BRAMSON (1842-1909), E. BALLION (1816-1901), A. BECKER (1818-1901), N. M. ROMANOFF (1859-1919), A. A. JACHONTOV (1879-1973), L. A. SHELJUZHKO (1890-1969), V. V. SOVINSKY (1881-1957), M. A. RJABOV (1890-1962), E. S. MILJANOWSKI (1908-1976).

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Life Histories and Biology – Entwicklung und Biologie – Biologie

An attempt at the classification of six species of *Satyrus* (s.l.) based on morphological characters of the early stages (Nymphalidae : Satyrinae)

Enrique García-Barros and José-Luis Viejo

The early stages of many European Satyrini have long been known, but no attempt has been made to evaluate their importance in classification.

In a preliminary approach based on a small number of species, we attempt to assess the results of including egg, larval and pupal characters together with adult features (mainly those previously used in taxonomic arrangements of this group) when calculating overall similarities among species.

The possible relevance of some morphological features of the immature stages of *Satyrus* s.l. is briefly discussed.

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Phenological synchronization and adaptation in five satyrine butterflies from central Spain

Enrique García-Barros

This communication summarizes the results of breeding experiments and field observations of five satyrines from central Spain : *Hipparchia alcyone* D. & S., *H. semele* L., *H. statilinus* Hufn., *H. fidia* L. and *Maniola jurtina* L. The phenology and behaviour of these five species in the study area is stated and briefly compared with the literature data.

The patterns of adult seasonal abundance differ among the five species, but the dates of oviposition and the beginning of larval feeding periods are, as a general rule, remarkably similar. This can be regarded as the result of a synchronization of the larval feeding periods with the period when rains are expected and consequent growth of the larval foodplants. As stated by previous workers on the subject, it appears that the seasonal pattern of larval feeding of temperate monovoltine satyrines has been strongly influenced by the seasonal distribution of rains in temperate areas. Thus, it is suggested that some phenological adaptations known from temperate satyrines (delayed ovarian maturation, first instar larval quiescence) might have evolved as responses to the occupation of dry areas (or climatic changes) in certain species.

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Some biological and behavioural notes on the Scythrididae (Gelechioidea)

P. Passerin d'Entrèves & C. Fessile

Five larvae of *Scythris flaviventrella* (Herrich-Schaeffer) were collected on Mount Rocciamelone, at an elevation of about 1000 m (Valley of Susa : Prov. of Torino : NW Italy). Two of them were found on *Helianthemum apenninum* (Mill.) [Cistaceae], and three on *Astragalus onobrychis* (L.) [Papilionaceae]. This is the first report of the occurrence of this species in Italy.

The caterpillars were raised using the same plant species as foodplant. In this connection it is relevant to observe that *Scythris flaviventrella* is a member of the strictly pea-family eating '*aerariella* group' (Passerin d'Entrèves 1982). The species had previously only been known to feed on *Vicia* sp.

The mature larvae are marbled orange-grey in colour and measure 13 mm in length. They weave a loose fabric of silk joining leaves of the foodplant together, shielding a more closely knit silken tube. The latter is used as a shelter and is attached to the plant's stem. The imagines emerged 10-12 days after pupation.

Courtship took place in the upper part of the breeding cage where the two partners flew separately (Fig. 1). The males probably discover females from their pheromone emissions and start following them, walking about 10 cm behind. After a while, the female continues to walk straight ahead, while the male follows a wide circular path, leading him to face the female from a distance of 5-6 cm. At this moment the male starts a series of three consecutive wing vibrations, each performed at a smaller distance from the female. When the two partners reach to touch each other by the tips of their antennae, they start vibrating their wings simultaneously, more quickly than during the previous part of courtship. The following step consists of opening their fore and middle legs until they reach a vertical position, and contact with the substrate is kept by their wing-tips and metathoracic legs only.

Then the male reaches forward with its abdomen, making contact with the female's genital opening. Once copulation has begun the two partners make a quick lateral rotation movement and assume a tail-to-tail position. The whole courtship lasts several minutes. Copulation normally takes place in the late afternoon and lasts 6-7 hours. During this time the two partners remain immobile. An attempt to disturb the pair made by an intruding male had no effect.

Each of our 2 females mated again, always with the same partner, about 48 h after the first copulation.

Author's address : Dipartimento di Biologia animale, Via Academia Albertina 17, I-10123 Torino, Italy.

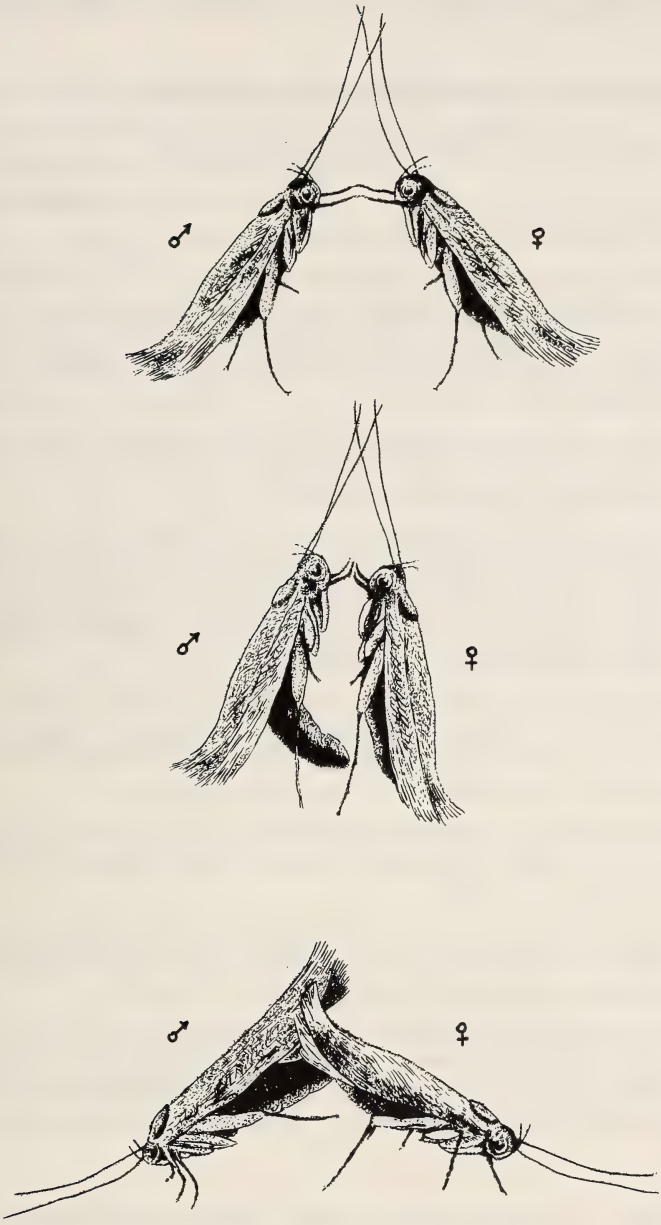

Fig. 1. The courtship of *Scythris flaviventrella* (H.-S.).

Nota lepid. 12 Supplement No. 1 : 70 ; 30.VI.1989 ISSN 0342-7536

Factors affecting flower choice in butterflies

V. Sarto I Monteys, V. E. Jones, K. Harrison & J. Ylla

Flower selection, for nectar feeding, by two species of tropical butterflies, *Eurema hecabe* and *Eurema brigitta* (Pieridae : Coliadinae), has been studied.

The trials, using one butterfly at a time, were run inside 3 × 3 × 2 m tents which contained flowering plants, on James Cook University Campus in Townsville, Queensland, between December 1986 and January 1987. A total of 16 species of flowering plants, belonging to 11 families, were offered to the butterflies ; 4 pots per plant species were used.

The butterflies were obtained from eggs laid on their foodplants ; they were sexed, tagged and released into the tents immediately after emergence. In this way the sex and age of butterflies in each trial was known.

The most important data recorded per trial were the number of open flowers per individual plant, number of initial flower visits and total settlings on each plant performed by a particular individual butterfly and time spent nectaring on those flowers. Other data were relative to the butterfly age, some weather parameters and average height of the flowers from the ground.

To enable interpretation of results three partial indices of flower preference by the butterflies have been defined as well as a total index. Such indices take into consideration the probability a particular type of flower has of being used as a nectar source according to its abundance in the tent when the trial was run.

The results are based on a recorded feeding time of 18565 sec and 20983 sec for *E. hecabe* and *E. brigitta* respectively. Recorded flower visits were 1869 for *E. hecabe* and 1108 for *E. brigitta.*

Results clearly support a non-randomized flower selection by the butterflies, the very likely existence of a search image at an individual level and significant differences in flower selection between species and sexes within the species.

The factors that might be responsible for such a selection, such as nectar components, colour of the flowers within the insect's visual spectrum, morphological features affecting the flower, such as shape, corolla width and length, nectar location, butterfly proboscis lengths, and others, are presently being measured and will be discussed.

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Nota lepid. 12 Supplement No. 1 : 71 ; 30.VI.1989 ISSN 0342-7536

Some faunistic and ecological aspects of the autumn and winter noctuid moths of a locality in Central Spain (Noctuidae)

José Luis Yela García

Noctuid moths (Lepidoptera : Noctuidae) were caught between early April 1983 and late May 1985 in Trillo, Guadalajara (Central Spain). This locality is 732 m above sea level in the Tagus Valley. Its climate is continental-mediterranean. The dominant type of vegetation is evergreen oak forest (*Quercetum rotundifoliae*), although other plant communities of some importance exist. Among these are the gall oak forest (*Cephalanthero-Quercetum fagineae*) and riparian forests (*Populion albae*). During the sampling period 250 watt mercury-vapour light traps were placed every 15 days in three locations : one in an evergreen oak forest, another in a gall oak forest and a third one in a small valley with riparian forest and orchards, so that we have generally taken two samples per month in each location (in some cases three samples per month). In this study we consider and discuss only the results obtained in the months between November and March, giving special attention to the supposed ecological preferences of the species for each plant community considered.

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Nota lepid. 12 Supplement No. 1 : 72 ; 30.VI.1989 ISSN 0342-7536

Spatial partitioning of *Heterogynis penella* Hb. cocoons : Evidence for sexual selection on larval behaviour (*)

Alberto Zilli & Tommaso Racheli

Heterogynis penella (Hübner, 1819) is a species with a west Mediterranean range. It is strongly sexually dimorphic. The males are normally winged and with plumed antennae. The females lack all cephalic and thoracic appendages and spend their life inside their cocoons, except when they protrude outside to attract the males for mating. After copula, the females return inside the pupal exuvia, eggs are laid and subsequently the young larvae devour their mothers. After this period of cannibalism the larvae change diet and move on to their foodplants.

In the central Apennines it has been observed that the female cocoons and hence the adult females are found on stems at higher levels than those of the males. This phenomenon can be explained as the result of intra-sexual selection in the females, in that female larvae need to climb up higher to be better exposed at mating time. The male larvae do not need to spin cocoons in prominent sites because the adults can fly.

The proposal of parental specialisation as the underlying factor which affects and regulates the intensity of sexual selection was examined. With a 1 : 1 sex ratio, members of the less specialised sex would need to compete more, because the reproductive success of one sex strongly depends on the meeting occasions with the other.

Because of the remarkable behaviour of the females, all their life being devoted to increasing their offsprings' chances of survival, intrasexual competition for mates should be expected to occur in the male sex. The unique life cycle affects the relevant population densities of both sexes : the females are more aggregated than males, which are scattered all over their habitat. For such reasons, males can be viewed also as a limiting resource to females, which attain their reproductive success only if they succeed in attracting the flying males. It is a selective advantage for the female to find a conspicuous position for releasing her sex pheromone and to succeed in attracting a male to her, rather than to one of the nearby females. The successful arrival of a male is likely to be influenced by visual cues, as the females retain the black and yellow-striped larval pattern.

(*) The research has been supported by grants M.P.I. 40% and 60%.

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Nomenclature and taxonomy – Nomenklatur und Taxonomie – Nomenclature et taxonomie

Confusion around *Kessleria zimmermanni* (NOWICKI) (Yponomeutidae)

P. HUEMER and G. TARMANN

The genus *Kessleria* is distributed in the Holarctic Region, Papua, New Guinea, Madagascar and New Zealand. Numerous species live in mountainous or even high alpine areas. The larvae feed mainly on various species of Saxifragaceae ; only a few taxa are able to exploit other host-plants.

NOWICKI described *Kessleria zimmermanni* from a large number of specimens collected in the Tatra mountains. In the original description almost no differences were noted between the sexes. In the early years of this century HAUDER collected a number of *Kessleria* in Styria and Upper Austria including two flightless females. Nevertheless, he identified this material as *zimmermanni*, as also did FRIESE with the population from Tyrol, believing that *zimmermanni* occurs in the Tatra and the Eastern Alps.

In 1960 FRIESE revised the Palaearctic Yponomeutidae including *Kessleria*. Although he did not examine any material of *zimmermanni* from the type-locality (Tatra), he described a new species, *tatrica*, from a single male collected in the Tatra. FRIESE's *'zimmermanni'* included males from Eastern Austria and specimens of both sexes from Tyrol. However, he obviously never dissected males from Tyrol nor females from Styria. Therefore, when the authors started a revisional work on *Kessleria* it was really surprising that *zimmermanni* sensu FRIESE is a mixture of two different species, one restricted to Eastern Austria, the other to Tyrol and both with flightless females. The species are easily distinguishable by their forewing markings and the genitalia of both sexes.

As a preliminary result of the previous revisional work on *Kessleria* the following proposals are stated :

(1) *Kessleria zimmermanni* is a species either restricted to the Tatra mountains or distributed in the Tatra and Eastern Austria.
(2) *Kessleria tatrica* is possibly a junior synonym of *zimmermanni*.
(3) The population from eastern Austria is either *zimmermanni* or, more likely, a distinct species.
(4) The population from Tyrol does not belong to *zimmermanni* and is possibly an undescribed species.

The confusion around *Kessleria zimmermanni* demonstrates the problems of modern taxonomy. The authors will try to examine all the original material and undertake additional field studies.

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Nota lepid. 12 Supplement No. 1 : 74-76 ; 30.VI.1989 ISSN 0342-7536

Les espèces ibériques du genre *Conistra* (Lepidoptères : Noctuidae). Critères pour l'identification des femelles par les genitalia.

Ibon DE OLANO

L'auteur a fait l'étude du genre *Conistra* HUEBNER (1821) dans la Péninsule ibérique, genre dont les espèces ont une phénologie hivernale, un cycle biologique univoltin, et dont les imagos ont une période de repos pendant la période la plus froide.

Il se base sur la «Lista Sistematica de los Noctuidae de la Peninsula» publiée au volume V de l'ouvrage «Mariposas de la Peninsula iberica» (GOMEZ BUSTILLO, ARROYO VARELA et YELA GARCIA, 1986), et sur la liste mise à jour des Noctuidae d'Alava (OLANO, MARCOS et SALAZAR, 1987). Le genre *Conistra* compte 11 espèces dans la Peninsule, groupées en deux sous-genres.

L'auteur fournit les données nécessaires pour l'identification génitale des femelles et des dessins schématiques des genitalia femelles.

C. (Conistra) vaccinii (LINNAEUS, 1761)
Deux signums larges et petits (Fig. 1).

C. (C.) ligula (ESPER, 1791)
Un signum large (Fig. 2).

C. (C.) alicia (LAJONQUIERE, 1939)
Un signum arrondi (Fig. 3).

C. (C.) veronicae (HUEBNER, 1813)
Deux rangées de signums arrondis qui se rejoignent en formant un V à l'envers (Fig. 4).

C. (C.) rubiginosa (SCOPOLI, 1763)
Bursa non arrondie, plaque chitineuse occupant le milieu du cervix (ostium bursae ?) ; deux rangées longitudinales de signums doubles de quatre faces et deux signums doubles à la base. (Fig. 5).

C. (C.) gallica (LEDERER, 1857)
Bursa arrondie, plaque chitineuse occupant un tiers du cervix ; trois rangées longitudinales de signums doubles (Fig. 6).

C. (C.) daubei (DUPONCHEL, 1838)
Plaque chitineuse caractéristique en forme de bec dans le cervix bursae (Fig. 7).

C. (C.) torrida (LEDERER, 1857)
Trois signums arrondis : deux grands à la base et un autre petit en haut et dans la face (Fig. 8).

Fig. 1
C. (C.)
vaccinii

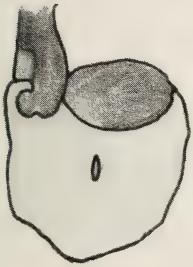

Fig. 2
C. (C.)
ligula

Fig. 3
C. (C.)
alicia

Fig. 4
C. (C.)
veronicae

Fig. 5
C. (C.)
rubiginosa

Fig. 6
C. (C.)
gallica

Fig. 7
C. (C.)
daubei

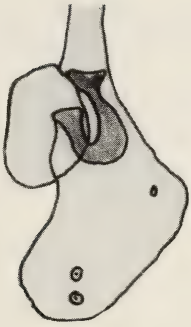

Fig. 8
C. (C.)
torrida

Fig. 9
C. (D.)
rubiginea

Fig. 10
C. (D.)
staudingeri

Fig. 11
C. (D.)
erythrocephala

C. (Dasycampa) rubiginea (Denis & Schiffermueller, 1775)
Trois signums longitudinaux larges, avec plaque chitineuse du ductus plus courte que dans l'espèce suivante (Fig. 9).

C. (D.) staudingeri (Graslin, 1863)
Quatre signums longitudinaux larges (Fig. 10).

C. (D.) erythrocephala (Denis & Schiffermueller, 1775)
Quatre signums longitudinaux larges, l'un plus séparé et plus épais ; grand cervix bursae (Fig. 11).

Adresse de l'auteur : Instituto Alaves de la Naturaleza, Arabako Natur Institutoa, Siervas de Jesús, 24 (Torre de Doña Ochanda), E-01001 Vitoria-Gasteiz, Apartado 2092, Espagne.

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Durch Umstände ausserhalb der Kontrolle der Redaktion, konnten die folgenden Fehler nicht mehr rechtzeitig vor dem Druck korrigiert werden.

A la suite d'un malheureux concours de circonstances, les erreurs suivantes n'ont pas pus être corrigé à temps.

Errata

P. 2 line 12 : for "interntional" read "international"
P. 6 line 44 : for "LINAEUS" read "LINNAEUS"
P. 17 line 36 : for "BSD" read "BSD"
P. 22 line 9 : Add comma after "In 1986", and remove comma after "population"
P. 23 line 2 : for "EHRHARDT" read "ERHARDT"
P. 30 References : for "EHRHARDT" read "ERHARDT"
P. 31 line 2 : for "Cane-Wright" read "Vane-Wright"
P. 43 line 1 : for "Treatened" read "Threatened"
P. 43 line 21 : for "Auchenorhynca" read "Auchenorhyncha"
P. 43 line 27 : for "*Veroffentlichung*" read "*Veröffentlichung*"
P. 61 line 39 : for "repealled" read "repealed"
P. 62 lines 2 ⟩ 19 : for "lepidoptera" read "Lepidoptera"
P. 63 line 9 : for "TOSHIRO" read "Toshiro"
P. 68 line 2 : for "lepidoptera" read "Lepidoptera"
P. 71 line 26 : for "I means" read "I mean"
P. 78 line 28 : for "*forsts*" read "*forests*"
P. 79 References, line 1 : for "scholor" read "scholar"
P. 84 line 15 : for "adress" read "address"
Inside back cover, line 4 : for "Prof. Hansjürg Geiger" read "Dr. Hansjürg Geiger"
Inside back cover, line 10 : for "Michael G. Morris" read "Dr. Michael G. Morris"

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NOTA lepidopterologica

Conservation of Lepidoptera
Schmetterlingsschutz
Protection des papillons

Supplement No. 2 1991 ISSN 0342-7536

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Introduction

In recent years, the importance of Lepidoptera as indicators for the ever increasing destruction of our environment has achieved more recognition. Campaigns by several national and international nature protection organisations have publicised the dramatic decline in our butterfly fauna. Although several SEL members have been involved in these campaigns, SEL as a whole has not yet been as active as it could be. The Council of SEL has been seeking ways of improving this situation, especially in view of the rapidly uniting Europe, and in this respect it was supported by the members at the last General Meeting. Considering our limited finances, the Council believes that SEL can best contribute to butterfly protection by providing national and interntional organisations with advice, based on the wealth of knowledge within its membership, and by publishing new findings and information on all aspects of butterfly protection. This special issue of Nota lepidopterologica should be seen as a first step in this direction. However, SEL can only actively contribute to butterfly protection if our members are prepared to help. In this connection, the Council is looking for members in the various countries of Europe who are prepared to write short reports on butterfly protection matters in their country (Please contact the editor).

Die Bedeutung der Schmetterlinge als Indikatororganismen für die fortschreitende Umweltzerstörung ist in den letzten Jahren verstärkt erkannt worden. Zahlreiche nationale und internationale Naturschutz-Verbände haben aus diesem Grunde in oft vielbeachteten Aktionen die Bevölkerung auf die dramatische Verarmung unserer Schmetterlingsfauna hingewiesen. Obwohl zahlreiche SEL-Mitglieder bei diesen Unternehmungen mitgearbeitet haben, hat sich SEL als Organisation bisher noch nicht im möglichen Ausmasse mit eigenen Aktivitäten hervorgetan. Der Vorstand von SEL möchte dies in Zukunft ändern, insbesondere auch vor dem Hintergrund eines sich rasch vereinigenden Europas, und ist in dieser Absicht durch Vorstösse von Seiten der Mitglieder an der letzten Generalversammlung unterstützt worden. In Anbetracht der begrenzten finanziellen Möglichkeiten unserer Gesellschaft erachtet es der Vorstand als am sinnvollsten, wenn SEL durch Beratung nationaler und internationaler Körperschaften das Wissen der Mitglieder bei Schutzbemühungen einbringt und neue Erkenntnisse und Meldungen über den Schmetterlingsschutz betreffende Ereignisse sammelt und publiziert. Die vorliegende Sondernummer soll in dieser Hinsicht einen ersten Schritt darstellen. SEL kann allerdings nur im Schmetterlingsschutz tätig werden, wenn unsere Mitglieder sich aktiv beteiligen. Der Vorstand sucht in diesem Zusammenhang noch immer Mitarbeiter in den verschiedenen europäischen Ländern, die bereit sind, Kurzberichte über die Geschehnisse in ihrem Land zur Verfügung zu stellen (Bitte sich beim Redaktor melden).

Ces dernières années, l'importance des Lépidoptères comme indicateurs de la destruction sans cesse croissante de notre environnement a été enfin reconnue. Les campagnes lancées par de nombreuses organisations, nationales et internationales, de protection de la nature ont sensibilisé le public à l'appauvrissement dramatique de notre faune en ce qui concerne les papillons. Alors même que plusieurs de nos membres étaient engagés dans ces campagnes, la SEL en tant qu'organisation ne s'est pas encore lancée dans ce domaine autant qu'elle aurait pu le faire. Le Conseil de notre société a donc cherché les voies et moyens pour remédier à cette situation, surtout dans le cadre d'une Europe en voie d'unification rapide. Tous les membres réunis lors de la dernière assemblée générale se sont déclarés d'accord de soutenir cet effort. Tenant compte des possibilités financières réduites de la SEL, le Conseil estime que le meilleur moyen pour notre société de contribuer à la protection des papillons consiste à mettre au service des organisations nationales et internationales le savoir de ses membres pour les conseiller en matière de protection, et à rassembler et publier les observations et renseignements d'actualité sur tous les aspects de la protection des papillons. Le présent numéro spécial de Nota lepidopterologica doit être considéré comme un premier pas dans ce sens. La SEL ne peut toutefois contribuer concrètement à la protection des papillons que si ses membres s'engagent activement à participer. Le Conseil de la SEL recherche donc encore à cet effet des collaborateurs dans les différents pays d'Europe qui seraient disposés à publier de brefs exposés sur ce qui se fait dans leur pays en matière de protection des papillons : Prière de s'annoncer au Rédacteur !

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Ranking species and sites for butterfly conservation using presence-absence data in Central Spain

Arturo Baz

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Summary

Rareness or percent occurrences of species is derived from presence-absence matrices (sites x species) and used to calculate a set of indices for ranking sites and species. The indices are designed to weight for sites with greater species richness and presence of rare species. UTM-grid squares with high index values are identified. The advantages and disadvantages of the method are discussed.

Introduction

Conservation efforts are often focussed on species that are rare numerically or have limited distributions, and/or sites that contain a high species richness in a relatively undisturbed state.

These two criteria (species richness and rarity) are the most used in wildlife conservation evaluation (Margules & Usher, 1981) and it is often only possible to obtain species presence-absence data for a series of potential conservation sites. The biotic data may be augmented with data on site characteristics such as area, superficial geology, vegetation, etc. Reserve planners and others must then decide which sites, if protected, would most achieve their conservation objectives.

Here I present an application of the numerical method of ranking species and sites (using species presence-absence data) used by Dony & Denholm (1985) and, more recently, by Minns (1987). The method is applied to the assemblage of native butterflies in Madrid province (Central Spain). Many native butterflies have limited distributions that have doubtless been reduced by human colonisation. There is a need to recognise species and sites requiring protection to conserve the native assemblage.

Methods

For ranking, the species assemblage and the total set of sites must first be defined.

In the application presented, the species assemblage is all the native butterflies in Madrid province (140 species) and the set of sites is the 109 UTM 100 km^2 squares of the same province (Fig. 1). The distributional data of the butterfly species in the UTM squares are extracted from the work of Gomez de Aizpurua (1987).

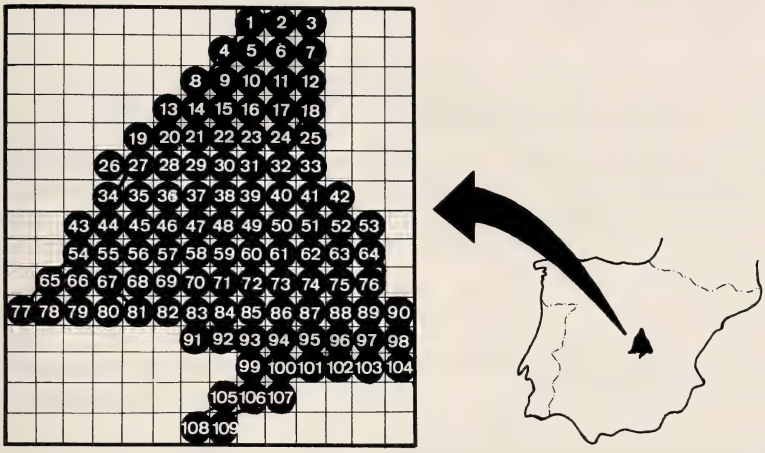


Fig. 1. Map representing the 109 UTM Km^2 squares of the Madrid province.

The required input data may be described as follows (see Minns, 1987).

Sites								
					Species assemblage			
i	1	2	3	.	.	.	.	m
1	S_{11}	S_{12}	S_{13}					S_{1m}
2	S_{21}	S_{22}	S_{23}					S_{2m}
3	S_{31}	S_{32}	S_{33}					S_{3m}
.	.	.	.	.	S_{ij}	.	.	.
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.
n	S_{n1}	S_{n2}	S_{n3}	.	.	.	.	S_{nm}

where n = number of sites ; m = number of species and S_{ij} presence (1)/ absence (o) of species j at site i.

The proportional occurrence (Pj) of species j across n sites is :

$$Pj = \sum_{i=1}^{n} Sij/n$$

the conservation priority (Qj) of each species is assumed to be the complement of its rareness, *Pj*.

$$Qj = 1 - Pj$$

Species which occur at all sites have a priority (*Qj*) of zero while species only occurring at one site have a $Qj = (n - 1)/n$. As the distribution of a species diminishes, so its conservation priority increases. The species in the assemblage can be ranked by their *Qj* values (see Table I).

Table I. Species with priorities values (*Qj*) ≥ mean + SD

Species	Qj values
Carcharodus flocciferus (Zeller, 1847)	0.99
Agrodiaetus amanda (Schneider, 1791)	0.99
Charaxes jasius (Linnaeus, 1766)	0.99
Carcharodus lavatherae (Esper, 1780)	0.98
Pyrgus fritillarius (Poda, 1761)	0.98
Aphantopus hyperantus (Linnaeus, 1758)	0.98
Clossiana euphrosyne (Linnaeus, 1758)	0.98
Clossiana dia (Linnaeus, 1767)	0.98
Brenthis ino (Rottemburg, 1775)	0.98
Pyrgus cirsii (Rambur, 1839	0.97
Aricia morronensis (Ribbe, 1910)	0.97
Cupido osiris (Meigen, 1829)	0.97
Hamearis lucina (Linnaeus, 1758)	0.97
Plebicula nivescens (Keferstein, 1851)	0.96
Euchloe belemia (Esper, 1799)	0.96
Artogeia mannii (Mayer, 1851)	0.96
Erynnis tages (Linnaeus, 1758)	0.95
Iolana iolas (Ochsenheimer, 1816)	0.95
Chazara prieuri (Pierret, 1837)	0.95
Apatura iris (Linnaeus, 1758)	0.95
Lycaeides idas (Linnaeus, 1761)	0.94
Gegenes nostrodamus (Fabricius, 1793)	0.93
Plebicula dorylas (D. & S., 1775)	0.93
Coenonympha glycerion (Borkhausen, 1788)	0.93
Erebia meolans (Prunner, 1798)	0.92
Pyrgus serratulae (Rambur, 1839)	0.91
Pyrgus armoricanus (Oberthür, 1910)	0.91
Pyrgus alveus (Hübner, 1810)	0.91
Aricia agestis (D. & S., 1775)	0.91
Satyrium acaciae (Fabricius, 1787)	0.91
Brenthis hecate (D. & S., 1775)	0.91
Libythea celtis (Laicharting, 1782)	0.91
Pseudophilotes abencerragus (Pierret, 1837)	0.90
Zizeeria knysna (Trimen, 1862)	0.90
Nymphalis antiopa (Linaeus, 1758)	0.90

The relative importance (*Ii*) of a site is defined as the sum of priorities of species present divided by the sum of priorities for all assemblage species.

$$Ii = \sum_{j=1}^{m} Sij\ Qj / \sum_{j=1}^{m} Qj$$

Of course this index is sensitive to the richness of the site. To compensate for that, a second site index is calculated which is the average priority (*Qi*) of species present.

$$Qi = \sum_{j=1}^{m} Sij\ Qj / \sum_{j=1}^{m} Sij$$

The importance index (*Ii*) can vary between 0 and 1 whereas the average priority (*Qi*) can vary in the range of species priorities (*Qj*) roughly between 0 and 1. Sites with a large portion of assemblage species present will tend to have high *I* and intermediate *Q* values. Sites with a few rare species will have intermediate *I* and high *Q* values. Sites with a few common species will have low *I* and *Q* values, or if both species richness and rarity are to be ranked the indices can be combined $(I + Q)/2$.

Results

The values of *I, Qi,* $I + Q/2$ and the number of species for each UTM square are summarized in Table II.

These values cover similar ranges and have similar means and standard deviations (Table III). Squares with index values greater than the mean plus standard deviation were selected (Figs. 2-5).

Fig. 6 represents the squares selected by all four indices and represents the definitive square selection for conservation.

The areas selected are the Central part of the Guadarrama mountains, the Ayllon massif, the Casa de Campo and monte del Pardo near Madrid, and the localities of Loeches and Campo Real in the south-eastern Plateau. Each zone is included in some of the faunistic units recognized by Viejo *et al.* (1988) using the same data.

Discussion

The importance (*I*) and average priority (*Q*) indices offer an objective means of ranking sites for identifying areas with greater species richness and concentration of rare species.

Rankings obtained with the numerical method were compared with selections made by experts (i.e. Gomez Bustillo & Fernandez Rubio, 1974 ; Viedma *et al.*, 1985). There is a very good correlation between the UTM squares selected by experts and those with $(I + Q)/2$ values greater than $\bar{x} + s$. These results suggest that the indices *I* and *Q* reasonably approximate the subjective selection process.

Table II. Values of *I, Qi*, $(I + Q)/2$ and number of species for each UTM square

Sites	I	Q_i	I + Q/2	No. sp.
1	0.54	0.55	0.545	87
2	0.55	0.55	0.550	90
3	0.27	0.46	0.365	53
4	0.32	0.47	0.395	62
5	0.28	0.44	0.360	58
6	0.45	0.47	0.460	85
7	0.38	0.45	0.415	75
8	0.16	0.45	0.305	32
9	0.32	0.48	0.400	59
10	0.41	0.49	0.450	74
11	0.30	0.40	0.350	67
12	0.27	0.40	0.335	61
13	0.45	0.51	0.480	78
14	0.40	0.51	0.455	70
15	0.25	0.45	0.350	50
16	0.34	0.45	0.395	67
17	0.19	0.34	0.265	50
18	0.25	0.39	0.320	58
19	0.52	0.52	0.520	89
20	0.59	0.56	0.575	94
21	0.25	0.45	0.350	49
22	0.14	0.36	0.250	36
23	0.12	0.30	0.210	34
24	0.22	0.36	0.290	55
25	0.22	0.38	0.300	52
26	0.58	0.53	0.555	97
27	0.61	0.55	0.580	99
28	0.55	0.52	0.535	94
29	0.18	0.36	0.270	45
30	0.24	0.41	0.325	52
31	0.21	0.37	0.290	52
32	0.20	0.36	0.280	51
33	0.27	0.41	0.340	58
34	0.44	0.47	0.455	82
35	0.59	0.52	0.555	100
36	0.35	0.43	0.390	73
37	0.25	0.40	0.325	57
38	0.17	0.32	0.245	47
39	0.03	0.18	0.105	17
40	0.07	0.26	0.165	24
41	0.06	0.22	0.140	23
42	0.07	0.35	0.210	18
43	0.24	0.38	0.310	57
44	0.26	0.38	0.320	61
45	0.31	0.41	0.360	66
46	0.16	0.32	0.240	46
47	0.18	0.35	0.265	45
48	0.34	0.42	0.380	72
49	0.19	0.33	0.260	51
50	0.04	0.23	0.135	18
51	0.15	0.35	0.250	39
52	0.21	0.38	0.295	49
53	0.15	0.34	0.245	40
54	0.25	0.37	0.310	60

Sites	I	Q_i	I + Q/2	No. sp.
55	0.22	0.35	0.285	57
56	0.17	0.32	0.245	49
57	0.23	0.35	0.290	58
58	0.21	0.35	0.280	54
59	0.34	0.43	0.385	70
60	0.10	0.37	0.235	26
61	0.11	0.36	0.230	27
62	0.31	0.48	0.395	59
63	0.13	0.32	0.225	35
64	0.25	0.38	0.315	57
65	0.17	0.32	0.245	48
66	0.18	0.33	0.255	50
67	0.22	0.35	0.285	55
68	0.20	0.35	0.275	51
69	0.20	0.34	0.270	54
70	0.21	0.34	0.275	56
71	0.10	0.28	0.190	32
72	0.14	0.34	0.240	36
73	0.27	0.40	0.335	60
74	0.35	0.44	0.395	70
75	0.20	0.40	0.300	46
76	0.30	0.40	0.350	64
77	0.12	0.28	0.200	37
78	0.18	0.33	0.255	49
79	0.18	0.31	0.245	50
80	0.15	0.31	0.230	42
81	0.14	0.30	0.220	42
82	0.16	0.31	0.235	46
83	0.13	0.29	0.210	41
84	0.09	0.26	0.175	31
85	0.07	0.29	0.180	22
86	0.13	0.37	0.250	31
87	0.15	0.36	0.255	38
88	0.27	0.41	0.340	59
89	0.24	0.37	0.305	56
90	0.20	0.37	0.285	50
91	0.14	0.30	0.220	40
92	0.11	0.29	0.200	34
93	0.12	0.32	0.220	34
94	0.12	0.36	0.240	31
95	0.21	0.38	0.295	49
96	0.24	0.38	0.310	56
97	0.22	0.37	0.295	53
98	0.26	0.43	0.345	54
99	0.24	0.37	0.305	57
100	0.23	0.39	0.310	53
101	0.09	0.29	0.190	29
102	0.12	0.32	0.220	34
103	0.11	0.34	0.225	29
104	0.12	0.34	0.230	32
105	0.05	0.26	0.155	19
106	0.27	0.42	0.350	59
107	0.28	0.43	0.355	58
108	0.28	0.43	0.355	58
109	0.02	0.21	0.117	11

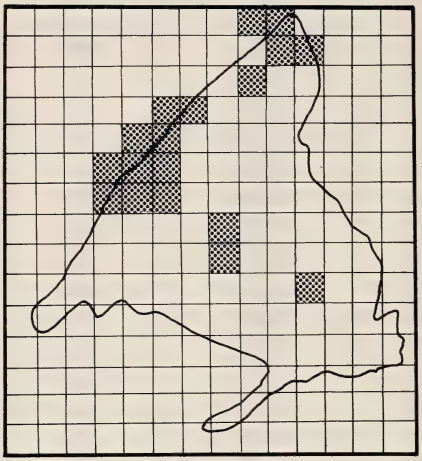


Fig. 2.

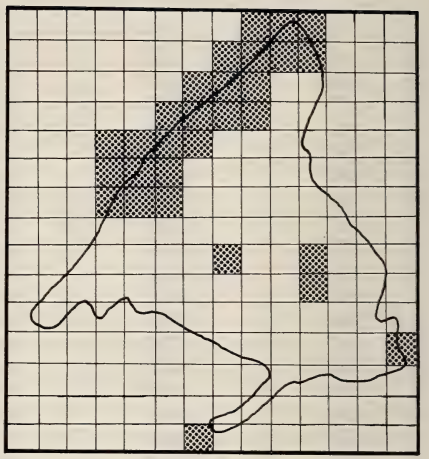
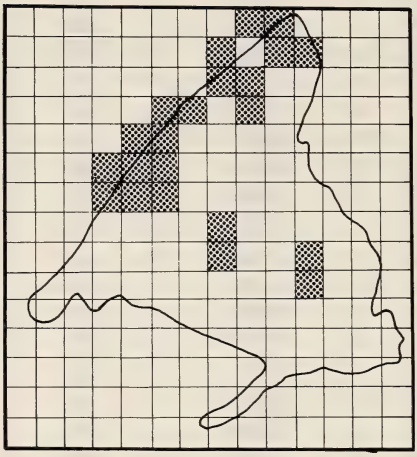


Fig. 3.



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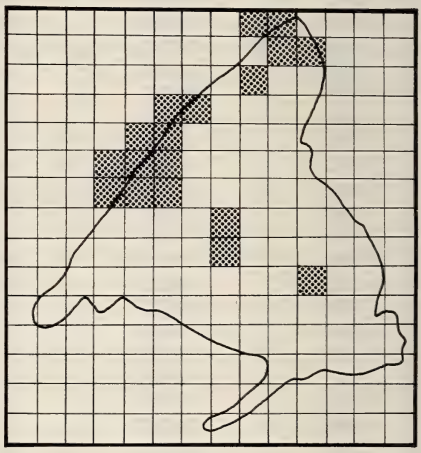

Fig. 5.

Fig. 2. UTM squares with $I \geq$ mean + SD.
Fig. 3. UTM squares with $Qi \geq$ mean + SD.
Fig. 4. UTM squares with $(I + Q)/2 \geq$ mean + SD.
Fig. 5. UTM squares with no. of species $\geq$ mean + SD.

The method is based on the recognition that conservation is a relative process with arbitrary bounds on the sites and species to be considered. The use of such a method decreases reliance of reserve planners on limited expertise. Used in conjunction with an extensive database, species and sites can be ranked in terms of national importance.

Table III. Minimum, maximum, mean, standard deviation (SD) and mean + SD of date presented in Table II

Index	Minimum	Maximum	Mean	SD	Mean + SD	n
I	0.03	0.61	0.23	0.13	0.36	109
Q	0.18	0.56	0.38	0.05	0.43	109
(I + Q)/2	0.10	0.58	0.30	0.10	0.40	109
species number	11	100	51.62	19.28	71	109

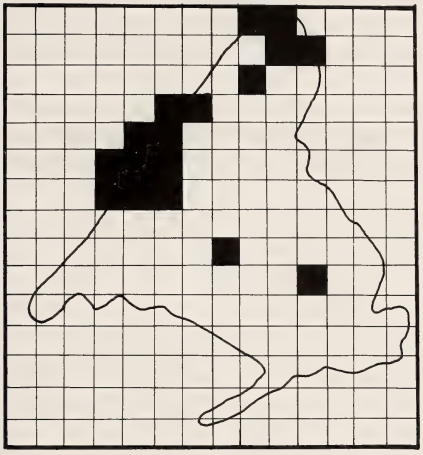

Fig. 6. UTM squares common to the four selection indices.

This method can be used more specifically. For instance, as Viejo & Viedma (1988) pointed out, the *Quercus* forests are the most important biotopes with regard to butterfly conservation. This method can be applied to the detection of forests which have a greater conservation priority in terms of national importance.

Basic presence-absence data for a particular site is often the only information readily available and in despite of its disadvantages (i.e. all species are not equally vulnerable to detection, all squares are not equally surveyed) this data must be utilised. Such methods must play an increasingly important role as the need for conservation grows.

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Zum Schutz der Schmetterlinge in der Schweiz : Die Notwendigkeit eines grösseren, wissenschaftlich fundierten Engagements

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Summary

This paper describes problems of butterfly conservation in Switzerland, which may also apply to other countries in Central Europe. The problem of the dependence of many of the remaining butterfly species on secondary anthropogenic habitats is raised with the example of *Maculinea arion*. Lack of knowledge on the ecology of European Lepidoptera is emphasized (e.g. description of larvae, larval hosts and adult resources, minimum areas of populations, influence of different types of management on Lepidoptera as well as on other animals and plants in nature reserves) as well as the value of Lepidoptera as indicators of structure and changes of the vegetation.

In Switzerland, stronger efforts for the conservation of Lepidoptera are urgently needed. The engagement of professional conservationists is a prerequisite for a more efficient and successful conservation of Lepidoptera. Amateurs are strongly encouraged to join these efforts but cannot be left to be fully responsible for the conservation of Lepidoptera.

Einleitung

Der Rückgang unserer einheimischen Schmetterlinge hat in den letzten zwei bis drei Jahrzehnten derart massive Ausmasse angenommen, dass er nicht nur von Fachleuten beklagt, sondern auch von wenig naturverbundenen Menschen registriert und bedauert wird. Sogar früher allgemein häufige Arten sind selten geworden. Aus „Roten Listen“ geht hervor, dass in der BRD 40-50% aller Lepidopterenarten in ihrem Vorkommen als gefährdet oder bereits ausgestorben oder verschollen angesehen werden müssen (Ebert 1978, Wagener *et al.* 1979, Pretscher 1984). In der Schweiz sind zwar noch keine Arten ausgestorben, gesamtschweizerisch sind aber ebenfalls 39% aller Tagfalterarten gefährdet (Gonseth 1987). Dieser Prozentsatz liegt in einzelnen Regionen sogar noch wesentlich höher ; so sind im Seeland bereits 80% !! der dort ursprünglich vorkommenden Tagfalterarten gefährdet oder bereits

ausgestorben (Bryner 1987). Für die Nachtfalter liegt momentan noch keine „Rote Liste" vor, doch dürfte ihr Gefährdungsgrad etwa demjenigen der Tagfalter entsprechen. Die Ursachen für diesen Rückgang sind vielfältig und in vielen Fällen offensichtlich, vor allem, wenn Habitate von Schmetterlingsarten einfach zerstört wurden (Überbauungen, „Melioration" von Feuchtgebieten, Gewässerkorrekturen, etc., vgl. Pretscher 1977, Blab & Kudrna 1982). Ein wesentlicher Faktor liegt zweifellos in der Industrialisierung der landwirtschaftlichen Bewirtschaftungsmethoden (Erhardt, 1985a, b, c) ; die blumenreiche Magerwiese mit den bunten Schmetterlingen gehört für viele in den Bereich unwiederbringlich verlorengegangener Nostalgie. Ausser diesen klar liegenden Fällen sind Schmetterlinge aber auch weltweit aus Gebieten verschwunden, welche zumindest bei oberflächlicher Beurteilung keine wesentlichen Veränderungen erfahren haben (Thomas 1984). Vor allem Verluste aus Naturschutzgebieten sind schmerzhaft und leider oft (noch) nicht erklärt.

Nun sind aber Schmetterlinge wegen ihrer Schönheit und Buntheit auch bei Laien besonders beliebt, sie sind wegen ihrer eindrücklichen Metamorphose auch als Symbolträger psychologisch bedeutsam. Bei den Griechen in der Antike waren Schmetterlinge Symbol für die Seelen der Verstorbenen. Man mag sich in diesem Zusammenhang fragen, inwiefern der Rückgang unserer Schmetterlinge nicht auch Symbol für eine seelische Verarmung unserer Zeit ist.

Parallel zu diesem Rückgang erfolgte aber auch eine Sensibilisierung und Bewusstwerdung der Öffentlichkeit. Während beispielsweise noch vor zwei Jahrzehnten der Ausdruck „Magerwiese" nur vegetationskundlich tätigen Wissenschaftlern und allenfalls einigen engagierten Naturfreunden vertraut war, wird dieser Ausdruck heute allgemein verstanden und in der Tagespresse verwendet, wobei allerdings offenbleiben muss, was sich der Durchschnittsleser unter Magerwiesen vorstellt.

Das erhöhte Bewusstsein um die Gefährdung unserer Schmetterlinge hat auch in der Schweiz ein vermehrtes Interesse an diesen Insekten geweckt. In der Folge sind ein Verbreitungsatlas der Tagfalter der Schweiz (Gonseth 1987) und ein prachtvoller Bildband über die Schweizer Tagfalter erschienen (Schweiz. Bund für Naturschutz 1987). Der relativ reichen populärwissenschaftlichen Literatur (z.B. Hediger 1984, Kappeler 1987, Blab *et al.* 1987, Schweiz. Bund für Naturschutz 1987) steht für Mitteleuropa und speziell für die Schweiz aber ein ausgesprochener Mangel an fundierten wissenschaftlichen Untersuchungen zu Ökologie und Populationsbiologie von Schmetterlingen gegenüber. (Ausnahmen : Geiger & Scholl 1981, Ruetschi 1985a, b, Erhardt 1985a, b, c, Descimon & Geiger 1988, Napolitano *et al.* 1988, Lörtscher 1988). So gibt es bisher beispielsweise nur für die subalpine Stufe eine Vergleichsuntersuchung der Lepidopterenfauna von Fett- und Magerwiesen (Erhard 1985a, b, c) ; für die montane Stufe fehlt eine solche Untersuchung noch immer, obschon sich zahlreiche generalisierende Behauptungen nicht nur in der populärwissenschaftlichen Literatur finden (z.B. de Marmels 1978, Kappeler 1987, Schweiz. Bund f. Naturschutz 1987).

Ein warnendes Beispiel : *Maculinea arion*

Die englischen Untersuchungen zur Ökologie von *Maculinea arion* L. sind ein eindrückliches Beispiel, welches die Notwendigkeit voll engagierter, professioneller Untersuchungen zum Schutz von Schmetterlingen aufzeigt. Erste Anstrengungen, *Maculinea arion* in England zu schützen, wurden schon vor 100 (!) Jahren unternommen (Thomas 1984, Morris in press). Trotz intensiver Bestrebungen und trotz der Mitarbeit mehrerer qualifizierter Wissenschaftler konnte der komplizierte Lebenszyklus dieser Bläulingsart aber erst 1976 restlos aufgeklärt, die Schlüsselfaktoren bestimmt und die zum Überleben von *Maculinea arion* notwendigen Massnahmen ergriffen werden (Thomas 1980). Tragischerweise kamen diese Massnahmen zu spät und konnten das Aussterben der englischen Rasse von *Maculinea arion* nicht mehr verhindern. Der dramatische Kampf um das Überleben der letzten englischen Population dieses Bläulings hat zweifellos seine Popularität verstärkt ; sein faszinierender Lebenszyklus ist heute zu einem Lehrbuchbeispiel geworden (z.B. Kappeler 1987).

Dieses Beispiel weist noch auf einen weiteren Umstand hin, der bisher kaum beachtet wurde, der mir aber ausserordentlich wichtig erscheint. Der einzige verbleibende Lebensraum für *Maculinea arion* in England waren Extensivweiden, also Sekundärhabitate anthropogenen Ursprungs. Ursprünglich muss *Maculinea arion* in England aber auch andere, vom Menschen nicht beeinflusste primäre Habitate besiedelt haben, von welchen sich diese Art in die anthropogenen Weiden ausgebreitet hat. Als Primärstandorte kommen möglicherweise Sanddünen in Küstengebieten in Frage. Diese Primärbiotope sind in der Zwischenzeit höchst wahrscheinlich ebenfalls durch menschlichen Einfluss (Überbauung, Zerstörung, Übernutzung) für *Maculinea arion* nicht mehr bewohnbar geworden, so dass diese Art in England schliesslich vollständig auf anthropogene Sekundärstandorte angewiesen war. Dass anthropogene Habitate extrem anfällig auf Veränderungen sind, liegt auf der Hand : eine Veränderung der Bewirtschaftungsform oder Aufgabe der Bewirtschaftung haben massive Veränderungen dieser Habitate zur Folge und können in kürzester Zeit grösste Teile der Flora und Fauna dieser Standorte zum Verschwinden bringen. Das Beispiel von *Maculinea arion* warnt aufs eindringlichste : von wievielen Arten unserer Magerwiesen wissen wir, wo ihre Primärstandorte sind ? Viele unserer Schmetterlingsarten, welche heute noch auf den verbleibenden Sekundärstandorten, vor allem Magerwiesen, Extensivweiden und frühen Brachestadien zu finden sind (Erhardt 1985c), dürften aus grossen Gebieten gänzlich verschwinden, wenn diese anthropogenen Sekundärstandorte noch weiter dezimiert werden.

Wissenslücken

Obschon Schmetterlinge im Vergleich zu anderen Insektengruppen gut untersucht sind, darf dies nicht darüber hinwegtäuschen, dass in der Autökologie, Synökologie und Populationsbiologie auch bei unseren einheimischen Schmet-

terlingen noch immer massive Wissenslücken bestehen. Noch immer gibt es vor allem bei den Nachtfaltern Arten, von denen nicht einmal die ersten Stände (Ei, Raupe, Puppe) beschrieben sind, oft sind auch die Larvalfutterpflanzen nur mangelhaft oder gar nicht bekannt oder beschränken sich auf die Bezeichnung „Niedere Pflanzen", als ob die Raupen der jeweiligen Arten wahllos alle niederwüchsigen Pflanzen als Nahrung annehmen würden (FORSTER & WOHLFAHRT, 1954-1981).

Noch viel weniger als über die Larvalfutterpflanzen ist über die Bedeutung des Blumen-, resp. Nektarangebots für die Imagines der einzelnen Arten bekannt, obschon grundsätzlich unbestritten ist, dass die Ernährung der Imagines im Lebenszyklus von Schmetterlingen eine entscheidende Rolle spielen kann. So wurde nachgewiesen, dass die Nahrung der Imagines einen Einfluss auf ihre Lebensdauer, die Populationsdichte und die Eiproduktion der Weibchen haben kann (GILBERT 1972, 1984, DUNLAP-PIANKA *et al.* 1977, MURPHY *et al.* 1983), dass das Blumenangebot die Wahl der Eiablageplätze von Weibchen beeinflussen kann (MURPHY *et al.* 1984) und dass verschiedene Schmetterlingsarten zum Teil sogar artspezifische Blumenpräferenzen haben (WATT *et al.* 1974, MURPHY 1984, ERHARDT, in Vorbereitung).

Eine weitere empfindliche Wissenslücke betrifft die Kenntnis der Minimalareale, welche notwendig sind, damit sich eine Schmetterlingspopulation über längere Zeiträume in einem Habitat halten kann. Während das Minimalareal von Lycaeniden unter Umständen wenige m^2 betragen kann (WARNECKE 1951), liegt es für den Segelfalter nördlich der Alpen vermutlich in der Grössenordnung von Hektaren wenn nicht gar km^2. Die berühmt gewordene Untersuchung von REMMERT (1979) an Feldgrillen zeigt, dass jährliche Populationsschwankungen sehr gross sein können und dass die Populationsdichte in schlechten Jahren auf weniger als einen Hundertstel (!) der Populationsdichte eines guten Jahres sinken kann. Das Minimalareal muss aber auch in schlechten Jahren das Überleben einer Population garantieren ; für die von REMMERT (1979) untersuchten Feldgrillen beträgt dieses Minimalareal 3 Hektaren. THOMAS (1984) gibt für eine Reihe von Tagfaltern Minimalareale von England. Die Grösse dieser Minimalareale reicht von 0.5-1 ha (einige Lycaeniden, Hesperiiden, u.a.) bis über 50 ha (*Apatura iris*), doch ist fraglich, ob diese Angaben wegen des stark unterschiedlichen Klimas auf Mitteleuropa übertragbar sind : über Minimalareale von Populationen mitteleuropäischer Schmetterlingsarten ist mir keine Untersuchung bekannt.

Im weiteren fehlen in Naturschutzgebieten der Schweiz Erfahrungen von Management-Einflüssen nicht nur auf die Schmetterlingsfauna fast vollständig. Dass Naturschutzgebiete nicht einfach sich selbst überlassen werden dürfen, ist mittlerweile eine bekannte Tatsache, welche sich nicht zuletzt wegen der schlechten Erfahrungen mit *Maculinea arion* in England durchgesetzt hat. THOMAS (1984) berichtet über weitere Arten, welche aus englischen Naturschutzgebieten verschwunden sind und deren Verschwinden vermutlich auf inadäquate oder fehlende Pflegemassnahmen zurückzuführen sind. Die in England gewonnenen Erfahrungen sind sicher eine wertvolle Hilfe, doch

dürften sie sich ebenfalls oft nicht direkt auf Naturschutzgebiete in Mitteleuropa und speziell in der Schweiz übertragen lassen. Die momentan in Naturschutzgebieten der Schweiz getroffenen Massnahmen sind sicher in den meisten Fällen sorgfältig überlegt, man ist jedoch oft allein auf die Erfahrung und die gute Intuition von Fachleuten angewiesen, wie ich es persönlich wiederholt erfahren habe, da eine solide, wissenschaftliche Basis für Pflegemassnahmen fehlt. Als erschwerend kommt hinzu, dass jedes Gebiet seine Individualität und damit seine eigenen ökologischen Bedingungen aufweist, welche bei Pflegemassnahmen ebenfalls berücksichtigt werden müssen.

Den grössten Arbeitsaufwand erfordert zweifellos die Ermittlung der Schlüsselfaktoren, derjenigen Faktoren also, welche von entscheidender Bedeutung für die Existenz einer Schmetterlingspopulation sind. Darüber können nur fundierte autökologische Untersuchungen Aufschluss geben. Intensive autökologische Untersuchungen müssen wegen des grossen Arbeitsaufwandes vorderhand wohl auf die am meisten gefährdeten Arten beschränkt werden, obschon Thomas (1984) mit Recht darauf hinweist, dass autökologische Untersuchungen von Schmetterlingsarten weit kostspieliger und arbeitsaufwendiger sind, wenn sie als Notmassnahme an wenigen überlebenden und höchst gefährdeten Populationen einer Art durchgeführt werden müssen, als wenn eine Art noch nicht akut gefährdet ist.

Der Indikatorwert von Schmetterlingen

In erster Linie sind Schmetterlinge um ihrer selbst willen schützenswert. Zudem haben sie aber auch eine grosse Bedeutung als Indikatoren, da sie ausgesprochen empfindlich auf Veränderungen ihrer Umwelt reagieren (Reichholf 1973, Utschik 1977, Thomas 1984, Erhardt 1985a, b, c, Warren 1985, 1989). Sie können dabei weit empfindlicher als Pflanzen reagieren ; es sei nur daran erinnert, dass ein einmaliger Ausfall einer erfolgreichen Reproduktion, vielleicht in einem klimatisch besonders ungünstigen Jahr, schon genügen kann, dass eine Schmetterlingspopulation an einem bestimmten Standort ausstirbt ; die meisten Schmetterlingsarten verhalten sich also wie einjährige Pflanzen, deren Samen höchstens eine einjährige Samenruhe haben. Im Gegensatz zu Schmetterlingen haben Pflanzen aber die Möglichkeit, mit vegetativem Wachstum oder mit langer Samenruhe ungünstige Zeiträume zu überbrücken. Diese Möglichkeit entfällt für Schmetterlinge fast vollständig. Einzig die Puppen von verhältnismässig wenigen Arten können zuweilen mehrmals überliegen (z.B. kleines Nachtpfauenauge, *Eudia pavonia* L., und *Euchloe simplonia* BSD).

Die empfindliche Reaktion von Schmetterlingen auf Struktur und Veränderungen der Vegetation macht sie auch zu besonders günstigen Organismen bei der Evaluation von Naturschutzgebieten. Ausserdem lassen sich Schmetterlinge im Gegensatz zu den meisten anderen Insektengruppen im Feld relativ leicht auf ihre Artzugehörigkeit ansprechen, vorausgesetzt, die Untersuchungsperson verfügt über die nötige Artenkenntnis, und schliesslich sind Schmetterlinge auch bei Laien besonders beliebt.

Als Beispiel sei eine Untersuchung aus der subalpinen Stufe der Schweizer Zentralalpen erwähnt (Erhardt 1985c), in welcher gezeigt werden konnte, dass die Erfassung der Schmetterlingsfauna bezüglich des Naturschutzes zu anderen Schlüssen als eine rein botanische Beurteilung führen kann. So sind verschiedene Brachestadien von Magerwiesen floristisch nicht von grösserem Interesse, beherbergen aber Schmetterlinge, für welche diese Sukzessionsstadien wichtige Refugien darstellen und welche in Magerwiesen fehlen. Als Beispiele seien nur gerade *Colias palaeno europome* Esp. oder *Vacciniina optilete* Knoch erwähnt, welche beide stenotop in Zwergstrauchbrachen mit *Vaccinium uliginosum* L. auftreten, oder die Geometride *Epione vespertaria* D. & S., welche nur gerade in einem südexponierten Birkenaufwuchs zu finden war. Als weitere Konsequenz dieser Untersuchung ergab sich, dass viele Schmetterlingsarten auch in der subalpinen Stufe als zumindest mittelbar gefährdet angesehen werden müssen, obschon die subalpine Stufe z.B. bei Blab & Kudrna (1982) als ein für Schmetterlinge wenig gefährdeter Lebensraum gilt.

Konsequenzen

Aus dem Dargelegten geht eindeutig hervor, dass in der Schweiz ein grösseres, wissenschaftlich fundierteres Engagement für Naturschutz im allgemeinen und für den Schutz von Schmetterlingen im besonderen dringend nötig ist. Die „Berne Convention" (Fernandez-Galiano 1989) und die „Resolutions of the International Congress : Future of Butterflies in Europe : Strategies for Survival, Wageningen (Netherlands), 14. April 1989" bestätigen diese Dringlichkeit. Wie rückständig noch immer der Schutz von Schmetterlingen beim Gesetzgeber in der Schweiz verankert ist, geht schon daraus hervor, dass nur einige wenige Schmetterlingsarten in einigen wenigen Kantonen überhaupt geschützt sind. Unter diesen befinden sich neben wirklich schützenswerten Arten erst noch zwar populäre aber keineswegs gefährdete Arten (z.B. *Vanessa io* L., in Schaffhausen, Burckhardt *et al.* 1980, oder sogar Wanderfalter (z.B. *Vanessa atalanta* L., ebenfalls in Schaffhausen, Burckhard *et al.* 1980), welche alljährlich aus dem Mittelmeergebiet nach Mitteleuropa einfliegen, nördlich der Alpen aber gar nicht bodenständig sind. Ein Biotopschutz für Schmetterlinge existiert beim Gesetzgeber in der Schweiz noch überhaupt nicht.

Bei allem Respekt und aller Hochachtung für die vielen wertvollen Beiträge von engagierten Laien darf und kann Natuschutz nicht einfach ehrenamtlich tätigen Laien und Laienorganisationen überlassen werden, wie das heute in der Schweiz noch immer weitgehend der Fall ist. Die Schaffung eines Institutes mit wissenschaftlichen Stellen für die Bearbeitung von Naturschutzproblemen und Pflegemassnahmen in Naturschutzgebieten in der Schweiz mag momentan etwas utopisch klingen, wäre meines Erachtens aber ein dringendes Anliegen. Dass die Schaffung eines solchen Institutes nicht notwendigerweise utopisch ist, haben die Engländer bewiesen, welche schon seit längerer Zeit eine entsprechende Forschungsstation (Institute of Terrestial Ecology, Furzebrook Research Station, Wareham) betreiben. Es ist ausserordentlich bedauerlich,

dass unter der momentanen englischen Regierung die Mittel für diese Forschungsstation empfindlich gekürzt werden (Morris, pers. Mitteilung). Die Mitarbeiter dieser Forschungsstation haben schon viele wertvolle Resultate erarbeitet, von welchen wir teilweise auch in der Schweiz profitieren. So stammt beispielsweise der Beitrag über die Gattung *Maculinea* im Buch „Tagfalter und ihre Lebensräume" (Schweizerischer Bund für Naturschutz, 1987) von J. A. Thomas, einem Mitarbeiter dieser englischen Forschungsstation.

Gleichzeitig möchte ich die vielen Laien und Hobby-Schmetterlingsliebhaber ermuntern, weiterhin und noch vermehrt an offenen ökologischen Fragen und an Naturschutzproblemen mitzuarbeiten ; diese Arbeit ist letztlich viel lohnender und befriedigender als die Komplettierung der eigenen Sammlung mit Raritäten.

Das essentielle Motiv für Naturschutz und damit auch für den Schutz des Menschen selbst (Portmann 1971) bleibt sich letzlich immer gleich, ohne dabei an Aktualität oder Kraft zu verlieren : Wir tragen die Verantwortung, die Vielfalt an Lebensformen und damit auch die Vielfalt unserer Schmetterlinge zu erhalten, so dass sich auch nachfolgende Generationen an dieser Vielfalt und Buntheit unserer Schmetterlinge freuen und die Symbolkraft dieser so leicht verletzlichen Wesen empfinden können.

Der Rückgang unserer Schmetterlinge ist zu massiv, als dass er noch weitergehen darf. Wenn dieser Aufsatz dazu beitragen kann, dass in der Schweiz und vielleicht auch in anderen Ländern Mitteleuropas die Anstrengungen für einen wirksameren und wissenschaftlich fundierten Schutz unserer Schmetterlinge intensiviert werden, dann wäre sein höchstes Ziel erreicht.

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Population biology of two satyrine butterflies, *Erebia meolans* (de Prunner, 1798) and *Erebia aethiops* (Esper, 1777) (Lepidoptera : Satyridae)

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Summary

In 1986 population dynamics and size of one population, each of *Erebia meolans* and *Erebia aethiops* were investigated in Grindelwald (Switzerland) with the capture-recapture method. Both species flew over a period of about three weeks, *meolans* in July and *aethiops* in August. Maximum estimate by the Lincoln-Index was 66 males for *meolans* and 458 for *aethiops*. Females appeared in both species only in the second half of the flight period in smaller numbers. Analysis of habitat use of the *aethiops* males showed a preference for a steep meadow with tall grass at the edge of a wood interspersed with bushes and small trees.

Zusammenfassung

Im Sommer 1986 wurden in Grindelwald (Schweiz) je die Dynamik und Grösse einer Population von *Erebia meolans* und *E. aethiops* mit der Fang-Wiederfang-Methode untersucht. Die Dauer der Flugzeit betrug für beide Arten ca. drei Wochen, *meolans* im Juli und *aethiops* im August. Bei beiden Arten traten die Weibchen erst in der zweiten Hälfte der Fangperiode in geringerer Zahl auf. Für die Männchen von *meolans* wurde mit dem Lincoln-Index ein maximaler Wert von 66 Tieren geschätzt, für *aethiops* hingegen 458 Tiere. Es konnte gezeigt werden, dass die *aethiops* Männchen im Untersuchungsgebiet eine deutliche Präferenz für ein von Wald begrenztes und mit Gebüsch und jungen Bäumen durchsetztes Stück Wiese zeigten.

Introduction

Major factors contributing to the disappearance of butterflies are agricultural intensivation (Blab & Kudrna, 1982 : 45-46 ; SBN, 1987 : 82-85) and abandonment of agricultural use, both with profound effects on vegetation.

In the long term, both lead to impoverishment of botanical and zoological diversity (Ehrhardt, 1982 ; Briemle *et al.*, 1987). Another factor is the lack of knowledge on the compatibility of environmental changes i.e. human interventions and the ecology of invertebrates. How determinant such knowledge can be, was shown clearly in the case of the Large Blue (*Maculinea arion*), whose extinction in Great Britain was caused, among other factors, by lack of knowledge of the intrinsic relationship between the butterfly, its ant-host and sheep grazing on their habitats (Thomas, 1980). The same fate could be reserved for a number of our butterflies if ecological research on their biology and the influence of environmental changes on them is not undertaken immediately.

The aim of the present study was to investigate and compare the population dynamics and size of two species of the satyrid genus *Erebia* : *E. meolans* (De Prunner, 1798) and *E. aethiops* (Esper, 1777). *E. aethiops* is found mainly in man-made environments, prone to intensivation or abandonment, while *meolans* lives in more natural habitats, but also in man-made habitats such as road verges. Thus both species are good examples of butterflies influenced by recent changes in alpine regions. The importance and value of the obtained results for nature conservation are discussed.

Material and methods

Location and species

The study was conducted at Grindelwald, Switzerland, in the summer of 1986. *E. meolans* is on the wing from May until the end of July and prefers short-turfed, rocky and rather dry hillsides. The population investigated was found at the "Grosse Scheidegg" at an altitude of about 1450 m along a steep, dry bank bordering a road interspersed with rocks, bare ground and short-turf vegetation.

Erebia aethiops is a species that appears later and flies from July until September. It can be found in a wide variety of man-made habitats, such as dry meadows, pastures with tall grass above the timberline and light woodland interspersed with clearings. The investigated population was found in an extensively used pasture at "Bachhalten" at an altitude of about 1450 m (Fig. 1).

Mark-recapture

Both populations were visited on 6 days over a period of three weeks, *E. meolans* between July 1 and July 21 and *E. aethiops* between July 28 and August 21. Towards the end of July after a period of adverse weather no more *meolans* individuals were found at that site. At the end of August, field observations were stopped and therefore the end of the flying period of *E. aethiops* was not followed.

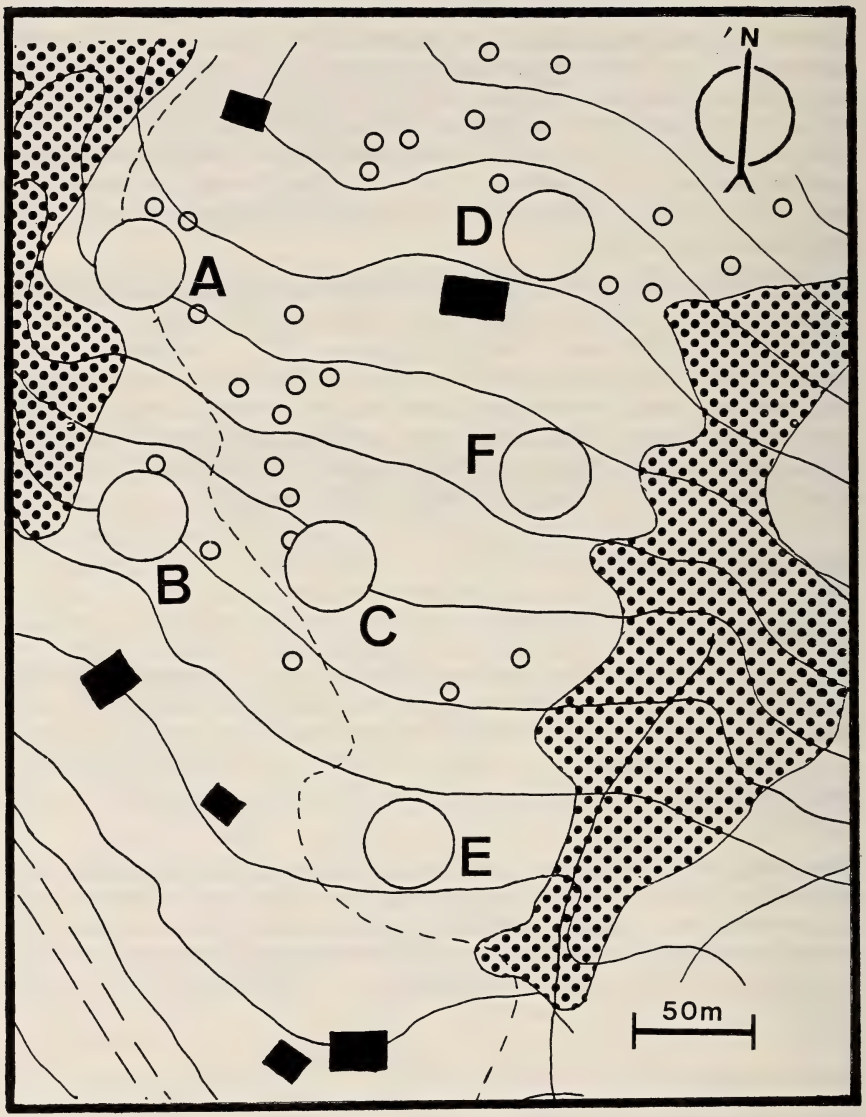

Fig. 1. Study site of the *aethiops* population at Bachhalten (Grindelwald). Dotted area = Wood ; Dotted line = Path ; Small Circles = Single trees ; Big empty circles = Subsites A-F.

Butterflies were netted by hand and marked individually by descaling the discoidal cell of the left hindwing underside and painting a number on the bare cuticle with an acryl cloth paint and a fine paint brush. Paint was preferred over the commonly used felt tip pen (GALL, 1985), because on the darkly coloured wings of Erebias such markings were not readable. Only three out of 280 marked specimens lost their markings. They were not included in the analysis. The butterflies were kept in a cool-box for several minutes after marking before being released in order to prevent an eventual "netting trauma" (WATT *et al.*, 1977). In the *meolans*-population, butterflies were caught by waiting at a particular site, where they had been observed patrolling during the preceeding year, and catching all individuals passing by. At the *aethiops* site, six subsites were defined according to previous observations and were visited regularly. The subsites were denoted with letters A-F according to the order of appearance of butterflies at those sites (Fig. 1).

One of the basic assumptions that has to be made with all mark-release-recapture-(MRR)-methods is the non-influence of marking on subsequent catchability. MORTON (1982) however, shows that in some species marking does influence subsequent catchability. This was not tested in either *meolans* or *aethiops*, so it cannot be excluded to have played a role in the results. To analyse the MRR-data, both Jolly's stochastic method (JOLLY, 1965) and the Lincoln Index (LINCOLN, 1930) were used. Jolly's stochastic model allows direct estimation of N_i only for days 2 through i-1. The M_{i-1} estimation used by WATT *et al.* (1977) was used to estimate N_i on the last sampling date. Capture data for the two initial days of sampling were pooled and used as first estimate in both populations. Data were tallied on a pocket calculator (HP-41) using a program by M. Zimmermann (University of Berne). For the detailed *aethiops* MRR-data, proportions of recaptured individuals, at sites of marking and at other sites were calculated for all six sites in order to show an eventual preference for a site within the pasture.

Dispersal in aethiops

To analyse dispersal behaviour in *aethiops*, distances flown between capture points were measured as straight lines between the centres of the subsites. Then the following per individual dispersal statistics were calculated according to GALL (1984) :

n = number of individuals recaptured
r = number of recapture events
d = distance between successive recaptures
R = individual range (d between two most distant recaptures)

The following statistics were determined on a population basis :
$\hat{d}$ = mean distance between recaptures ($\Sigma_{i=1} \Sigma_{j=1} d_{ij}/r$)
$\hat{R}$ = mean range ($\Sigma_{i=1} R/n$)
$\hat{D}$ = mean total distance ($\Sigma_{i=1} \Sigma_{j=1} d_{ij}$)

Results

E. meolans

The MRR-data are presented in Tab. 1. During the three week period 56 butterflies, 42 males and 14 females were caught and marked. Sex ratio was biased towards males by 3 : 1 ($X^2 = 7.5$, $p < 0.05$). 40% of the males were recaptured at least once, whereas 27% or three female butterflies were caught a second time. Their flight activity was chiefly confined to the second half of the observation period while male captures were distributed evenly over the investigation period.

Tab. 1. Mark-recapture-data of the *E. meolans*-population at "Grosse Scheidegg"

Date of visit :	1.7.	2.7.	10.7.	14.7.	17.7.	21.7.
captured on day i	1	21	10	14	20	15
♂♂ captured on day i	1	18	10	11	14	10
already marked	—	1	2	8	5	6
♀♀ captured on day i	—	3	—	3	6	5
already marked	—	—	—	—	1	2
Σ marked individuals	1	21	29	35	49	56

Population size estimates were only computed for males (Fig. 2) as there were too few female recaptures to yield satisfactory results. Except for the estimate on July 10 of 66 males, estimated numbers remained rather stable around 35 individuals. In *meolans*, both males and females, patrol along well defined paths, using rocky short-turf ridges (personal observation).

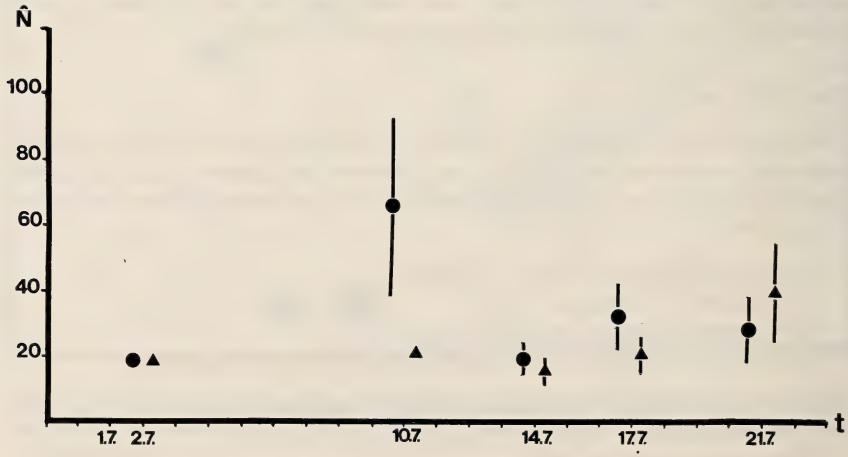

Fig. 2. Population size estimates for the male *meolans*-population at "Grosse Scheidegg" (Grindelwald) in 1986. ▲ = Jolly estimates, ● = Lincoln estimates.

E. aethiops

MRR-data are presented in Tab. 2. 284 butterflies, 241 males and 43 females were caught and marked. The sex ratio in *aethiops* with 5.6 : 1 is strongly biased towards males ($X^2 = 79$, $p < 0.01$). The sex ratio is even more strongly skewed than in *meolans* ($X^2 = 3.26$, $p < 0.1$). 30% of the male butterflies were recaptured at least once, whereas only one female was caught a second time. Female butterflies were caught mainly in the second half of the study period, that is 10 days after the first males had been marked. The population size estimates of the male population augmented steadily during the observation period and reached a maximum by August 21 of 338 (± 116) by Jolly's stochastic method and 458 (± 114) by the Lincoln-Index. This maximum has to be considered with care, as at the end of the investigation period, population size was still augmenting (see Fig. 3), so that it cannot be excluded that population size increased even further after that date. However on the occasion of a visit at the site ten days later, only very few *aethiops* were observed.

Tab. 2. Mark-recapture-data of the *E. aethiops* population at "Bachhalten"

Date of visit :	28.7	30.7.	6.8.	9.8.	15.8.	21.8.
captured on day i	10	13	73	91	100	85
♂♂ captured on day i	10	13	71	86	86	62
already marked	—	1	13	27	28	21
♀♀ captured on day i	—	—	2	5	14	23
already marked	—	—	—	—	—	1
Σ marked individuals	10	22	82	146	218	281

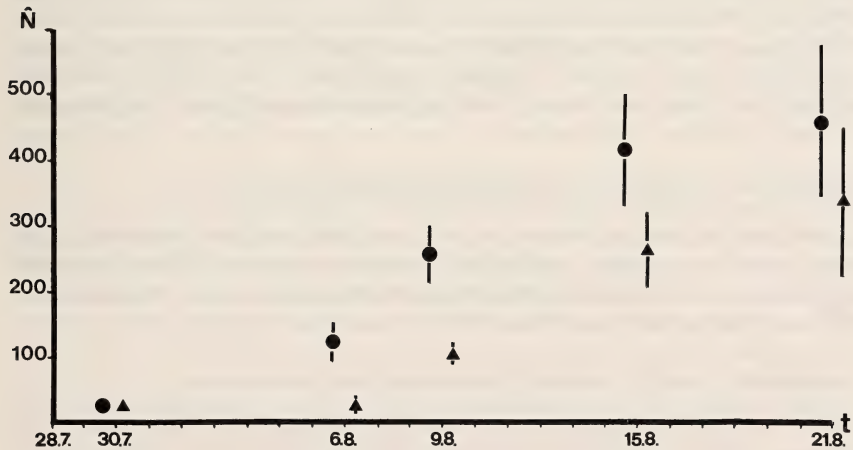

Fig. 3. Population size estimates for the male *aethiops* population at Bachhalten (Grindelwald) in 1986. ▲ = Jolly estimates. ● = Lincoln estimates.

Habitat use and dispersal in E. aethiops

Detailed MRR-data for the *aethiops* males are shown in Tab. 3. The same number of males was marked at subsite A as in the other five subsites together. 30% of the marked males at site A were recaptured at that same site, whereas only 14% were recaptured at another site. On the other hand at least as many recaptures at site A as on the original site of marking were made. Site A thus appears to be the very centre of activity of that male population. It is a fairly steep slope in the vicinity of a wood interspersed with bushes and small trees. Its size is about 15 by 30 meters.

Tab. 3. Detailed mark-recapture-data for the male *aethiops*-population at "Bachhalten" in 1986. Rows left of the double bar : number of individuals caught and marked at the sites. Rows to the right of the double bar : Individuals recaptured at the sites in %.

		Recapture at Site X in %				
Marked at Site X		Site A	Site B	Site C	Site D	Site E
Site A	126	31%	6%	2%	5%	1%
Site B	43	23%	14%	0	12%	0
Site C	10	33%	33%	0	10%	0
Site D	45	13%	7%	2%	0	0
Site E	17	18%	12%	0	0	0
Total	241	25%	9%	1%	5%	½%

The dispersal values for *aethiops* males yielded a mean distance between recaptures ($\hat{d}$) of 101 meters, a mean range ($\hat{R}$) of 108 meters and a mean total distance ($\hat{D}$) of 136 meters. Maximum distance flown by an individual over the whole investigation period was ca. 520 meters. Maximum distance flown on one particular day was ca. 260 meters. The size of the whole investigation area was 5 ha. Outside this area no *aethiops* were observed nearer than 1.5 km. There, another population was found, of which 270 individuals were marked in the same period. However, no exchange of individuals between the two populations was observed.

Comparison of population size of aethiops *and* meolans

To compare the sizes of the two populations, their maximum estimates were tested according to White *et al.* (1982) with the two tailed Z-Test. The result ($Z = 22.7$, $p < 0.01$) confirms the impression that the *meolans* population in 1986 was much smaller than the *aethiops* population.

Comparison of Jolly's stochastic method and the Lincoln-Index

One of the essential assumptions of the Lincoln-Index is that neither birth or immigration nor death or emigration influence the population investigated (Begon, 1979). If such events occur, the Lincoln-Index yields systematic overestimations for both the first and the second capture event (Seber, 1982).

If there are only immigration and birth, the estimate concerns the second capture event and if there are only death and emigration it concerns both events (Begon, 1979). Therefore at the beginning of the investigation period the estimates should be pictured at the second capture date and in between towards the end. For a comparison of the Lincoln-Index and Jolly's stochastic model however, they were all pictured at the second capture date (Figs. 2 & 3). On all but one date the Lincoln-estimate was significantly higher than the Jolly-estimate ($Z_p < 0.05$).

Discussion

As all results concern one investigation period only, generalisations are difficult to make. Especially concerning population size estimates, one-year studies on population dynamics neglect possible yearly fluctuations in population size, a phenomenon usual in the Genus *Erebia* (Warren, 1936). Furthermore, as was pointed out by Ehrlich (1984), within-species diversity in ecological features such as population size, dispersal or larval foodplants can be rather great. However, there are some results that deserve further discussion. The present study shows that *E. aethiops* is confined to a rather limited well defined area which it rarely leaves. For *E. meolans*, from the population size and other observations one could presume the same. *E. aethiops* males showed a clear preference for a small area of tall-grass pasture surrounded by woodland and interspersed with bushes and small trees between which they patrolled, while *meolans* was mainly observed patrolling along well defined habitat structures such as rocky ridges at the border of meadows or roads. Sex ratios were more biased towards the male side in the *aethiops* population. From personal observations the author concludes that the main reasons for this are behavioural differences between the sexes in the two species. Males were mainly observed patrolling, but females on the other hand mostly resting or basking on flowers or in the vegetation. Consequently males were much more prone to capture, as only butterflies passing by were caught and marked. These behavioural differences were less pronounced in *meolans*, thus possibly accounting for the less skewed sex ratio.

Population size estimates differ greatly among the two species. The maximum estimate for the male *aethiops* population counted 458 individuals in 1986 whilst the male *meolans* population reached only 66 individuals. The small size in *meolans* raises the question whether this population is part of a metapopulation in the Grindelwald region as was shown for the checkerspot butterfly *Euphydryas editha bayensis* in the San Francisco Bay area (Harrison *et al.*, 1988). Through its small size it is constantly prone to extinction by chance events but may be recolonized by large, constant "mother"-populations. The Grindelwald region contains several other *meolans* populations (Schiess, 1988), so that this hypothesis would be worth further examination.

The observed population features, i.e. rather small size, restricted area, little dispersal (for *aethiops*), compare rather well with several other studies of

different butterfly species (GALL, 1984 ; BRUSSARD *et al.*, 1974 ; EHRLICH, 1984). The only other study dealing with a representative of this genus by BRUSSARD & EHRLICH (1970) on *Erebia epipsodea* showed that it occurred in vast, effectively panmictic populations which may cover hundreds of square kilometers. On the limits of its distribution however, it apparently shows a more colonial population structure as a consequence of a patchy distribution of a resource, possibly a specific larval host (EHRLICH, 1984). This example shows that it would be very risky to draw conclusions about the population structure of *meolans* and *aethiops* from the small insight this study yields. Furthermore MURPHY *et al.* (1986) suggested that standard mark-recapture statistics alone are insufficient to reveal adult population features that distinguish species susceptible to extinction from those that are comparatively more secure. Much more should be known and that knowledge can only be obtained through long term studies over a large area of the species distribution. BERRY (1989) put these needs into words for his presidential address at the British Ecological Society by saying : "Ecology is concerned with dynamic interactions. These may lead to change or stability, but they can be recognized only by collecting observations over a period of time. Long-term data series are not fashionable ; they appear to funding agencies as an open-ended commitment. We must defend them, because they are our only way of actually determining what is going on in the real world around us".

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Progress in the conservation of butterflies

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Introduction

The better conservation of butterflies in Europe depends on a complex combination of factors, of which scientific research is only one, though a very important one. In particular, we stress the point that, however good the research is, only its acceptance by an informed and aware body of public opinion and conservation decision-makers can ensure, through implementation of its findings, that it is properly used. In recent years there have been encouraging signs that research has begun to be applied to conservation problems in the field more readily than has previously been the case.

One aspect of the complex nature of the factors affecting the conservation of Lepidoptera populations is the different perceptions that are current about what is important for practical conservation. Despite strong evidence that the primary cause of most declines in butterfly populations is habitat destruction, or what amounts to the same thing, habitat change, much attention continues to be focused on other issues. These may either be themselves relatively unimportant, or may place a wrong emphasis on a particular matter, or may fail to take it far enough. Thus, legislation often tends to be negative, concentrating on the prevention of "over-collecting" or disturbance rather than habitat protection, management and re-creation.

Use of insecticides has assumed an importance in the decline of butterfly populations which is not merited by a critical examination of the evidence available. The acquisition of nature reserves has been given its right prominence, but in some cases without sufficient attention being given to their management.

It is not our intention in this paper to dwell on past failures but to point out some of the successful ways in which the scientific problems associated with the conservation of Lepidoptera have been solved. Many of the suggestions made by Thomas (1984b) have already been put into effect or started. The importance of survey and monitoring continues to be recognised in many European countries and the results are being used in practical conservation. The proposed emphasis on research, reserves and re-introductions (Morris 1981c) is still valid. However, a comprehensive review of progress during the last 9 years is not appropriate or possible, largely because of the great activity which there has been in this field. In this paper we therefore

concentrate almost exclusively on the problems posed by the conservation of butterflies which inhabit grassland, referring only briefly to the species of other biotopes. We draw heavily on experience in the United Kingdom, though many of the problems and their solutions are equally valid elsewhere in Europe.

The historical background

In most parts of Europe, grasslands are communities of plants and animals which have been created by man for the nourishment and breeding of the domestic animals on which he has depended for much of his food, power, transport and clothing. These communities were established by the clearance of the climax forest vegetation (the wildwood) which developed after the end of the last ice age. Grasslands were created by the interaction of available plant species with grazing animals, often sheep and cattle. The agricultural technology in use up to the beginning of the 20th century could be complex, but was not highly developed, and as a consequence utilisation of potential photosynthetic production was inefficient in terms of energy transfer. This allowed for considerable diversity of both plants and animals in the community, although such diversity was produced unintentionally and unconsciously. There was also diversity in the types of grassland created. Partly this was mediated through soil type, but water régime was also an important influence. So also was the use made of the grassland vegetation, whether directly by grazing animals (pasture) or indirectly by growing a crop of hay (meadows). In many cases, of course, direct and indirect use on any one site were combined in seasonal or sequential use. Whatever the exact use, grasslands were established as plagioclimax communities in which succession of the vegetation was opposed by its removal to feed sheep and cattle.

There were few obvious competitors for grassland production in Britain until the rise of the rabbit (Sheail 1971). From being an introduced and valued domestic animal kept in managed warrens, rabbits became a feral species and a major agricultural pest. Despite competing with sheep, in particular, rabbits contributed to the maintenance of grasslands by grazing and scratching the sward.

About 1950, two major changes started to become apparent on British lowland grasslands. One was relatively gradual and only dramatic in its most intensive, recent phase ; this was the decline of pastoral farming and the rapid conversion of most level or gently-sloping land to arable for the production of cereals by the heavy use of nitrogenous fertilisers. The other change, sudden and very obvious, was the great reduction of rabbit populations by the *Myxoma* virus in the years following 1954.

Current grassland problems

Species-rich lowland grasslands in Britain have been greatly reduced in extent. It is estimated that only *c.* 4000 ha of semi-natural chalk grassland, for instance,

remain in Britain. Those areas which are left have been either under-managed or managed with difficulty. Nature conservation bodies are not often equipped to keep sheep or cattle just for management of nature reserves. Consequently, even reserves especially established to conserve species and communities dependent on grazing have been neglected. In many cases, other methods of management, such as mowing, have been tried, often without a complete monitoring of the effects on plants, animals and communities.

The association of a wide range of diurnal Lepidoptera with different types of grassland in subalpine Switzerland has recently been demonstrated (Erhardt 1985). Species-richness was high under traditional, non-intensive management and in the early stages of abandonment after intensive use. But few species persisted under intensive agricultural management, nor in areas where trees and shrubs began to be established.

Even where it has been possible to re-impose grazing management, there has often been a lack of appreciation of the complexities and subtleties of the interaction between the vegetation, the grazing animals and the invertebrate fauna. Possibly because of over-reaction to the need to re-introduce grazing, it has tended to be too intensive or too continuous in some cases. The distinction between reclamation management, imposed to bring a real grassland character back to a neglected site, and maintenance management, designed to keep that character, has not always been recognised.

There has also been little appreciation of the differences in objectives between agricultural and conservation management. The desire to maximise, or increase, agricultural production has been the reason for many of the changes which have destroyed large numbers of sites once rich in grassland Lepidoptera. A realisation that wildlife conservation was an unconscious production of agricultural management is long overdue. The corollary is that conservation management has the potential to be far more responsive to the needs of particular species of plants and animals and the communities of which they are part.

A major problem arising from the destruction of so many sites is that those which are left have become extremely isolated. In these areas, Lepidoptera which become extinct, often through lack of management, do not have the ability, as they once did, to re-colonise from nearby sites. The management of these species requires in many cases the re-establishment of populations by artificial means (Morris 1981c, Thomas 1984b). We discuss some examples below.

Grassland Lepidoptera — some case histories

Several studies of individual species have recently been undertaken in Britain which demonstrate some of the problems which confront butterfly conservationists. These studies also suggest ways in which populations of each species may be enhanced and managed on protected sites, particularly nature reserves.

The species concerned are not great rarities, nor are they especially endangered in Europe as a whole. There is some evidence to suggest that the problems encountered by species on the edge of their range where the climatic environment is generally colder and wetter than elsewhere in Europe may not be widespread. For example, at least 3 of the species described below as needing short or sparse turf to survive in Britain can occupy taller or denser swards further south in Europe where the microclimate is warmer at ground level. Nevertheless, the detailed investigations of the ecology of these species are of interest to most lepidopterists.

C. D. Thomas (1985a, b) studied the lycaenid butterfly *Plebejus argus* at a number of sites in Britain. This species apparently inhabits a broad range of biotopes in England and Wales, where it is widely distributed (Heath *et al.* 1984), but local. It is locally common on limestone grassland in North Wales, but has disappeared from many grassland, and other sites elsewhere. Thomas (1985b) showed that, despite the wide range of biotopes inhabited and foodplants utilised, *P. argus* is actually very restricted in its occurrence. The eggs are laid where short vegetation and bare ground meet, and only where the microclimate is warm. The larvae feed only on the youngest and most succulent terminal shoots of the foodplants. And the adult butterfly is sedentary, so that the rate of colonisation of new ground is also slow. It is this combination of characteristics which has restricted the butterfly's habitat and ensured that many former sites for it have become unsuitable through growth of coarse grasses following myxomatosis and the decline in sheep farming.

Rather similar habitat conditions were required by another lycaenid in Britain, *Maculinea arion*. Historically, this species was much more restricted in the British Isles (Spooner 1963), and colonies were lost throughout the 19th and 20th centuries, though most rapidly in the period from about 1950 to 1979, when the last-known colony became extinct (Thomas 1980). The early stages of *M. arion* are dependent on short grassland vegetation, but in this case because the preferred ant host, *Myrmica sabuleti*, occurs abundantly only on very short turf (Thomas 1984b). On former sites for the butterfly, surveys have shown that although the foodplant of the first 3 instars (*Thymus drucei*) may remain abundant, growth of coarse vegetation has nearly always brought about extinction of *M. sabuleti*. The grassland management necessary to retain populations of *M. arion* is particularly intensive. Now that this is understood, a protected site where it is hoped to re-establish the butterfly is being grazed at an appropriate intensity.

Another lycaenid butterfly of high conservation importance in Britain is *Lysandra bellargus*. Its ecology has several features of interest (Thomas (1983a). The butterfly is restricted to the south of England and adults are relatively sedentary. The larvae feed on the leguminous herb *Hippocrepis comosa*, which in Britain grows only on calcareous soils. Ovipositing female butterflies lay almost exclusively on plants growing in turf only 1-4 cm high. The daily temperature in spring and summer is much higher here than it

is in taller vegetation. Larvae of *L. bellargus* are almost invariably attended by ants, which are attracted to the honeydew secreted from pores distributed over the body and also from a Newcomer's gland. At night and during moults, ants bury or wall-up larvae in cells constructed of soil particles. Pupae are also attractive to ants and have been found in ants' nests. Several species of ant attend *L. bellargus* larvae ; those recorded at the sites where THOMAS worked were *Myrmica sabuleti*, which occurs only in very short turf, and *Lasius alienus*, which is generally a species of dry, warm soils.

Between the years *c.* 1950 and 1983, numbers of colonies of *L. bellargus* halved every 12 years as a result of lack of grazing making many sites unsuitable for the early stages of the butterfly. Since 1983, grazing has increased on many sites and colonies are being lost at a slower rate. However, because of the butterfly's poor powers of dispersal and the increasing isolation of sites, artificial re-establishment must be used in the conservation of the species ; this is discussed later in this paper.

The "skipper" butterfly *Hesperia comma* also inhabits chalk grassland hills in Britain and has a similar range to *L. bellargus*. Before 1940, it occurred in other parts of England (HEATH *et al.* 1984). Only about 49 populations still survive (THOMAS *et al.* 1986). The larval foodplant is the grass *Festuca ovina*, which is widely distributed in Britain and is not confined to the chalk hills of the south. The key feature of the ecology and behaviour of the species is the extreme fussiness of the ovipositing female in choosing egg-laying sites. The small *F. ovina* plants must be largely surrounded by bare ground or chalk scree and they must be growing in sheltered sun-spots. It is clear that myxomatosis has caused a drastic decline in the butterfly ; reduced numbers of rabbits have allowed the vegetation on many former sites to grow up and swamp the open habitat of the larvae of the butterflies. There is some evidence that recently-increased grazing by sheep and rabbits has begun to reverse this trend. However, like *L. bellargus, H. comma* is a poor colonist and improved sites are mostly only potential, rather than actual, habitats for the butterfly.

The 4 examples so far given — *Plebejus argus, Maculinea arion, Lysandra bellargus* and *Hesperia comma* — are all dependent on short grassland and hot microclimatic conditions near the ground. However, not all species of butterfly respond to grassland which is intensively managed so as to produce a short sward. *Thymelicus acteon* (Hesperidae) is a common European species which is very restricted in its distribution in Britain, being confined to only a small part of the coast of southern Britain, particularly the county of Dorset (HEATH *et al.* 1984). The butterfly is thus on the edge of its range in Britain, where its larval foodplant is the coarse grass *Brachypodium pinnatum* (THOMAS 1983b). This is a tall-growing species which has flourished in the absence of grazing by domestic stock and rabbits, and has spread in the unimproved calcareous pastures typical of this part of England. As a consequence, populations of *T. acteon* are now very numerous. In 1978, 83 colonies were found in the county of Dorset, only 36 (43%) of which had been recorded previously. Several of these colonies were very large : one was

Table 1. The habitat requirements of 5 intensively-studied British grassland butterflies

Species	Sensitive stages	Veg. height	Bare ground requirement	Food and quality	Foodplant specificity	Relationship with ants	Colonising ability adults
Plebejus argus	Oviposition Larval feeding	Medium-short	Yes	Young shoots	No	Faculative	Poor
Maculinea arion	Larval adoption by ants	Very short	Less important	Buds ; ant eggs, grubs, prepupae	Yes	Obligate & specific	Poor
Lysandra bellargus	Oviposition Larval feeding	Short	Yes	Foliage	Yes	Faculative	Poor
Hesperia comma	Oviposition Larval feeding	Quite short	Yes	Foliage	Yes	None	Poor
Thymelicus acteon	Oviposition Larval feeding	Tall	No	Foliage	Yes	None	Poor

estimated to have over 100,000 individuals on the peak day of emergence and 4 had over 10,000 (Thomas 1983b). It is thought that *T. acteon* is now more abundant in its English haunts than it has ever been since it was discovered in Britain in 1832.

In summary, 4 of the 5 species which have been studied intensively require short turf, hot microclimatic conditions, and, in most cases, bare ground adjacent to the foodplants chosen for oviposition. These conditions are most usually produced by intensive management. But one species requires a minimum of grassland management and flourishes in the absence of grazing. The main habitat features necessary for the survival of each species are summarised in Table 1.

Other grassland insects

The effects of grassland management, or cessation of management, on a variety of other insects have been studied in Britain. Because most of these species do not have the conservation importance of butterflies, many of the studies have examined the effects of management on the species-richness and diversity of the fauna. Investigation of intensive grazing has emphasised the importance of vertical structure of both individual plant species and the vegetation for the diversity of a range of insects, particularly Auchenorhyncha (Hemiptera) (Morris 1967, 1971a, b). Under cutting management as well as grazing, some species are characteristic of short turf, although more species are associated with tall vegetation (Morris 1981a, b). Burning, as a method of grassland management, has similar effects (Morris 1975), while human trampling of grassland produces very severe reductions in the insects present, for instance Coleoptera (Duffey 1975). Various species of Coleoptera are characteristic of short and tall vegetation (Morris & Rispin 1987) and cutting reduces species-abundance and diversity while changing the proportions of phytophagous as against fungivorous, saprophagous and detritivorous species (Morris & Rispin 1988). The rejuvenating effect of reimposing management on a neglected or uncut grassland is important (Morris & Plant 1983). The problem of maintaining short and tall vegetation simultaneously, for the conservation of butterflies like *L. bellargus* and *H. comma*, on the one hand, and *T. acteon*, on the other, together with numerous counterparts in other insect groups, can be solved by rotational management. For most sites, particularly where the aims of management specify the maintenance and enchancement of diversity, rotational management, especially grazing, is to be preferred to uniform intensive treatment.

Colonisation and re-establishment

Some very successful research has been done in both Europe and North America on the population dynamics of butterflies. However, a major problem often exists in studying the adult population, because immigration and emigration cannot be quantified in studies of particular populations. Species

of butterfly vary very considerably in their normal mobility and "strategy" of habitat utilisation. Many species exist as closed colonies, or may be assumed to do so. This can be tested by successive estimates of abundance using the frequency of capture method on marked individuals (Craig 1953, Eberhardt 1967). If population estimates stabilise over time, and provided mortality and emergences are small, then the population may be considered to be a closed one (Pollard 1977, Thomas 1983a). However, open populations still present a problem, as it is important that immigration rates be known. A recent approach has been to examine the possibility that "natural markers" can be used to identify the origins of individuals in the populations. Dempster *et al.* (1986) studied differences in the elemental composition of individuals of the common pierid butterfly *Gonepteryx rhamni*. This is a very mobile species and adults are believed to migrate between hibernating and breeding sites (Pollard & Hall 1980). The chemical composition of individual butterflies was examined by wavelength dispersive X-ray fluorescence spectrometry. Considerable differences were found between the sexes of *G. rhamni*, and between individuals taken on different sites and in different years and seasons. The elements which mostly discriminate between individual butterflies were potassium, calcium, phosphorus, zinc, chlorine and sulphur. Variation in these and other elements studied appears to result from differences in the composition of the soil at the breeding sites and the plants on which the larvae fed. However, despite the promise of this technique, its use seems to be limited because the specific "locality imprint" is soon destroyed as the butterflies feed and age.

More recently, a similar approach has been made to studying movements of individuals and their significance for populations in another mobile pierid, *Anthocaris cardamines*. The larvae of this species feed on a variety of Cruciferae, but mainly in southern England on *Cardamine pratensis*, a plant of wet meadows and woodland rides, and *Alliaria petiolata*, a hedgerow species of mostly drier soils. Analysis of mustard oils present in individual butterflies may help to determine their origin, as these chemicals are highly distinctive of the different larval foodplants (Dempster *pers. comm.*).

The mobility of individual butterflies and the ability of species to found new colonies is an important aspect of their conservation. The examples of *Lysandra bellargus* and *Hesperia comma* emphasise that, under present-day conditions, natural re-colonisation of "vacant" sites is an increasingly infrequent and unlikely event. Even when previously unmanaged areas of grassland are brought back to a suitable condition for butterfly species which required a short turf, the sites are often isolated and surrounded by crops or other biotopes across which the insects do not fly. In these circumstances the conservationist must take on the rôle played by nature in earlier times. Opposition to the artificial re-establishment of species is becoming increasingly muted as the case for controlled and responsible re-establishments becomes more urgent and obvious (Morris & Thomas 1989). A code of practice has recently been produced which sets out the desirable steps which should

be taken before, during and after an attempt at re-establishment is made (Joint Committee for the Conservation of British Insects 1986).

Numerous successful re-establishments of different species have been made in the past, though few have been adequately recorded. One exception is a re-establishment of *Lysandra bellargus* made on Old Winchester Hill, a chalk grassland National Nature Reserve in southern England. The butterfly became extinct on the site before 1960, as a result of cessation of grazing. Management re-started after a period of years, and in particular a rotational grazing system was imposed on the south-facing slope of the reserve in 1980. The site is almost completely surrounded by arable land, and it was calculated that the nearest colony of L. *bellargus* was 25 miles (40 km) distant. The re-establishment, which was made in 1981, was an instant success and the new colony is flourishing, though, like all populations of this species, it has fluctuated considerably in numbers.

This example illustrates a number of important aspects of the re-establishment of butterfly populations. As well as some very successful attempts at re-establishments there have been a few failures. Many of these have occurred because the correct ecological conditions, though well understood, could not be reproduced. A well-documented example is the attempt to re-introduce the English Swallowtail *Papilio machaon britannicus* to Wicken Fen, where it became extinct in 1952. A well-planned release of imagines was made, but the fen is too dry to support an adequate population of the larval foodplant (Dempter & Hall 1980).

Butterflies of other biotopes

In this paper we have concentrated on grassland butterflies, emphasising the importance of biotope management and the changes which are produced when it ceases. These are phenomena of more general application. British woodlands, in particular, are very far from being similar to the primeval "wildwood". It is becoming increasingly evident that management, especially to produce small timber products by the practice of coppicing, has been essential to the maintenance and survival of woodland butterflies. Widespread neglect of coppice woodlands, mostly because of economic forces, together with considerable replacement of deciduous mixed woodlands by single-species plantations of exotic conifers, has resulted in many local extinctions of several species. Some of these are insects which were regarded as common only a few decades ago. Work on the ecology and conservation of these species is continuing. One recent example of such work, and the prescriptions which have been formulated for management and conservation, is the detailed study of the butterfly which was thought to be most at risk of extinction in Britain after *Maculinea arion*, the small nymphalid *Mellicta athalia* (Warren 1985). This is another species which is rare and local in Britain though abundant and widespread in continental Europe. Its habitats need to be carefully and intensively managed if it is to survive in the British Isles.

A group of species which are rare, declining in numbers of colonies, and thus threatened in continental Europe, is the 4 or 5 species of *Maculinea*. Work on the ecology and habitat requirements of these butterflies was begun by THOMAS (1984a) and is continuing. The 2 species *M. teleius* and *M. nausithous* often inhabit the same small, mesotropic bogs and have the same larval foodplant (*Sanguisorba officinalis*). Eggs of both species are frequently laid on the same *Sanguisorba* plants, but the larvae of *M. nausithous* survive only in the nests of the ant *Myrmica rubra*, which lives in scrubby, submarginal areas, whereas *M. teleius* parasitises *Myrmica scabrinodis*, which lives in the more open, central region of the bog. The larvae of *Maculinea rebeli* (which, ecologically at least, appears to be specifically distinct from *M. alcon*) survive in the nests of another species of *Myrmica, M. schencki*, whilst *Maculinea alcon* uses *Myrmica ruginodis*. With *Maculinea arion* associated particularly with *Myrmica sabuleti*, it is becoming clear that each species of *Maculinea* butterfly characteristically parasitises a different species of *Myrmica* ant.

The conservation of tropical species

The problems of conserving tropical butterflies are often very different from those which beset conservationists in Europe, although in both cases the destruction of habitats is the main threat to populations, and ultimately to species. Western attitudes towards conservation are often highly inappropriate in the Third World, where increasing living standards and the quality of life, particularly for the rural poor, are important and laudable goals. Consequently, development is an overriding objective in most Third World countries and conservation has to be implemented within that context. This is the reason for the emphasis on "Conservation for Development" in the World Conservation Strategy. One aspect of this approach is to consider wildlife, including butterflies and other insects, as a resource to be utilised. The farming of butterflies for the decorative-, and more especially the specialist trades, is already successfully in progress in Papua New Guinea (National Research Council 1983), appears to be spreading to other parts of the tropics. With the rise in popularity of "butterfly houses" in Europe, especially in the United Kingdom and North America, the live trade, too, is well situated to help the Third World utilise its butterfly resource.

Even in Europe it is often difficult to obtain precise information on the status of a particular species, especially for the whole of its range. Accurate data on status may often not be adequate to determine causes of decline, and research will usually be necessary to elucidate these problems. However, documentation is also important. Thus, the report produced by HEATH (1981) has been invaluable in determining priorities for the conservation of Europe's butterflies and in indicating where gaps in our knowledge lie. HEATH's report was built on the various national conservation efforts, particularly the Red Data Books. International RDBs for more popular groups such as mammals and birds have been in existence for some time. A selection of the threatened invertebrates of the world was made by WELLS *et al.* (1983), but the first

comprehensive Red Data Book for an insect group is COLLINS & MORRIS (1985) for the Papilionidae of the world. Naturally, this is only a means to an end : the information published in the RDB needs to be corrected, updated and elaborated. The book can be used to designate an action plan for papilionid conservation, but this in turn will be ineffectual unless practical action can be taken. European lepidopterists and conservationists can contribute to this programme. Closer to home, *Papilio hospiton* is categorised as an Endangered species, yet information on the species and its conservation has been difficult to obtain.

Epilogue

Conservationists often appear to be fighting a lost cause, or at least to be losing in a rearguard action to preserve species, populations and habitats. While it remains true that many of our Lepidoptera species continue to be under threat, we are also beginning to understand the ecology of some of them much better and to see where the priorities for conservation action lie. Economy of effort and means is an important consideration in the promotion of effective action. Future emphasis must be to focus on actual problems and real solutions. Conservation has added a new and important aspect to the study of Lepidoptera, and this may be expected to continue to grow and develop.

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Use of UTM maps to detect endangered lycaenid species in the Iberian Peninsula

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Summary

UTM distribution maps of 20 species of Iberian Lycaenidae included in Red Data Books or Lists have been prepared. Maps are presented for 10 species with a severely restricted distribution, that are present or have been recorded from less than thirty 10 km UTM squares (0.5% of the squares in the Iberian Peninsula). These species are considered to be endangered. Species recorded from 30 to 50 UTM squares are considered to be vulnerable, and those present in more than 50 squares and widely distributed in the Peninsula are treated here as not endangered. The validity of this classification of status is discussed and the importance of conserving some areas in which two or more endangered species are present is emphasized, especially in the case of the Sierra Nevada in southern Spain.

Introduction

Although Spain was the first country for which a concern for insect conservation was documented (PYLE *et al.*, 1981), real efforts towards the conservation of insects did not take place until recent times.

The first step towards the conservation of Lepidoptera in Spain was the publication of the "Libro Rojo de los Lepidópteros Ibéricos" (Iberian Lepidoptera Red Data Book, VIEDMA & GOMEZ BUSTILLO, 1976) in which the criteria to select rare or endangered species is a subjective one, but based on the authors' good general knowledge of the status of the Iberian species. The book was revised in 1985, new species were added, others were excluded, and some distribution of species and selection criteria updated. Nevertheless the criteria to select species remained a subjective one.

HEATH (1981), dealing with European endangered species, used the same selection criteria, at least as far as Iberian species is concerned. Another milestone in insect conservation, including Iberian data, is the book of COLLINS & WELLS (1987) dealing with particularly endangered species. Some Iberian endemics are considered in this book, and it has been used as a basis for the insects listed in the appendices of the Bern Convention.

Real conservation measures in Spain include declaration of National Parks and Nature Reserves by the Spanish Government. These protected areas were created mainly to conserve vertebrates or places of "outstanding beauty". Some management usually takes place in such areas, but the goal is always to save endangered mammals or birds. Priority has never been given to invertebrate conservation ; insect populations have been assumed to be unaffected by the changing environment.

A proposal to protect an area of central Spain possessing a rich butterfly fauna has recently been made (Viedma & al., 1985). Several studies were carried out in the area, but despite all the efforts of lepidopterists and conservation authorities, a motorway actually runs through the very centre of the area.

Nevertheless, some work with a conservation background is being undertaken in Spain. We would like to mention as examples some important mapping research in northern Spain (Gomez de Aizpurua, 1988) and several papers from Viejo and co-authors (e.g. : Viejo & al., 1989) dealing with the value of different kinds of forests from the conservation point of view.

In this paper we use the number of 10 km UTM squares in which each species has been cited to select endangered lycaenid species in the Iberian Peninsula. The resulting list of species and their status is very similar to those obtained with more subjective methods, but we think our method is more acceptable from the scientific point of view, because it allows some quantification of the vulnerability of rare species.

Materials and methods

We have selected for our study 20 Iberian lycaenid species, taken mainly from the list of Viedma & Gomez Bustillo (1976), but with the addition of some rare species from other lists and from our own experience.

Data for the distribution maps were gathered using bibliographic citations (open circles in the maps) and also data compiled by us (closed circles) from the following public or private collections : Museo Nacional Ciencias Naturales, Museo Zoología Barcelona, Sociedad Ciencias Naturales Aranzadi, Museo Ciencias Naturales Vitoria, Departamento Biología Animal Universidad Complutense Madrid, Departamento Biología Universidad Autónoma Madrid, Fidel Fernández-Rubio, Arcadi Cervelló, Luis Núñez. For some very rare species we have included data from personal communications of experienced collectors. The complete list of localities and UTM coordinates with the bibliographic or collection references are given elsewhere (Munguira, 1989).

Distribution data were processed using a HP 85 computer and an automatic cartography program for the Iberian Peninsula & Balearic Islands (Rey, 1984). The maps were printed by a plotter attached to the computer.

Results

We consider a species "endangered" when it is present in the Iberian Peninsula in less than thirty 10 km UTM squares, "vulnerable" when present in 30 to 50 squares and "out of danger" when it has been found in more than 50 squares.

In this study we present maps of the 10 endangered Iberian lycaenids (Figs 1-9 ; *Maculinea alcon* and *M. rebeli* are included on the same map to show the geographical segregation of these two close species). We also include an example of a vulnerable species (Fig. 10) and of a previously listed species which we consider out of danger (Fig. 11). Table 1 is a comparison of all the Red Lists referring to the Iberian Peninsula with our own data (status and number of UTM squares in which each species has been cited).

The analysis of the maps shows the importance of several areas for the conservation of endangered lycaenids. The areas in which at least two endangered species are present are as follows :

— Sierra Nevada (Granada Province) : two endangered and a vulnerable species. The endangered species (*Agriades zullichi* and *Lysandra golgus*) are restricted to this Sierra and therefore the conservation of the area should be held as a priority.
— Abejar and Sotillo del Rincón (Soria Province) where two endangered species of *Maculinea* are present.
— Sierra de Aralar (Navarra Province), from where *Strymonidia pruni* and *Maculinea alcon* have been recorded.
— Fuente De (Santander Province) : a locality with *Agriades pyrenaicus* and *Maculinea alcon*.
— Viella in the Valle de Arán (Lérida Province), La Molina (Gerona Province) and Encamp Cortals (Andorra) where *Aricia nicias* and *Maculinea rebeli* occur.

Discussion

Several authors have used the number of UTM squares in which a species is present to pinpoint endangered species. Thus Gomez De Aizpurua (1988) in Northern Spain follows Leclercq *et al.* (1980) and considers a species as "rare" when present in less than 20 (10 km) squares out of a total of 500 (4%). The same criteria was used by the latter authors for Belgium & Luxembourg (rare when present in less than 4% of a total of 400 squares). When dealing with larger areas the 4% criteria produces too many squares and therefore Usher (1986) suggests a smaller percentage for the British Isles, considering a species as rare when cited in less than 15 squares (0.5% of the roughly 3200 squares of the Isles). We have adopted this last criteria with the 30 squares (0.5% of the roughly 6000 squares of the Peninsula).

Fig. 1. Distribution of *Strymonidia pruni* in the Iberian Peninsula. Closed circles are citations confirmed by the authors and open circles are bibliographic citations.

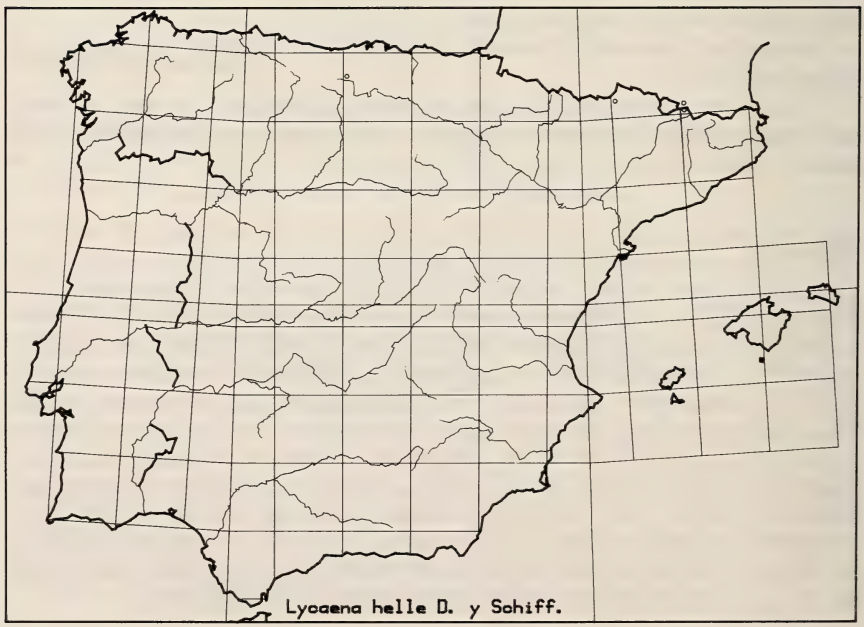

Fig. 2. Distribution of *Lycaena helle* in the Iberian Peninsula. Closed circles are citations confirmed by the authors and open circles are bibliographic citations.

Fig. 3. Distribution of *Tarucus theophrastus* in the Iberian Peninsula. Closed circles are citations confirmed by the authors and open circles are bibliographic citations.

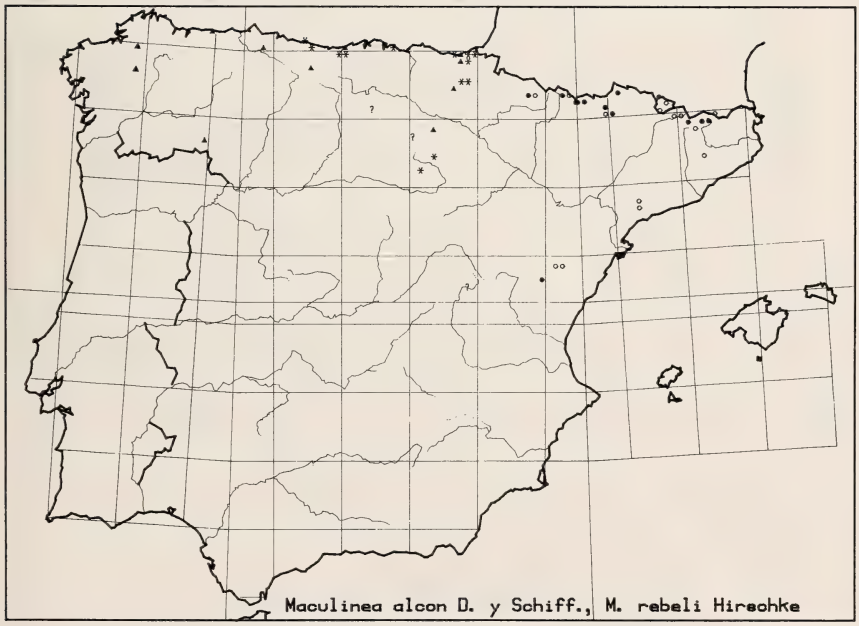

Fig. 4. Distribution of *Maculinea alcon* and *Maculinea rebeli.* Asterisks (*) and triangles (▲) are respectively confirmed and bibliographic citations of *M. alcon.* Closed circles and open circles are respectively confirmed and bibliographic citations of *M. rebeli.* Question marks (?) are erroneous citations.

Fig. 5. Distribution of *Maculinea nausithous* in the Iberian Peninsula. Closed circles are citations confirmed by the authors, open circles are bibliographic citations and question marks (?) are erroneous citations.

Fig. 6. Distribution of *Aricia nicias* in the Iberian Peninsula. Closed circles are citations confirmed by the authors and open circles are bibliographic citations.

Fig. 7. Distribution of *Lysandra golgus* in the Iberian Peninsula. Closed circles are citations confirmed by the authors and open circles are bibliographic citations.

Fig. 8. Distribution of *Agriades zullichi* in the Iberian Peninsula. Closed circles are citations confirmed by the authors and open circles are bibliographic citations.

Fig. 9. Distribution of *Agriades pyrenaicus* in the Iberian Peninsula. Closed circles are citations confirmed by the authors and open circles are bibliographic citations.

Fig. 10. Distribution of *Cupido lorquinii* in the Iberian Peninsula. Closed circles are citations confirmed by the authors, open circles are bibliographic citations and question marks (?) are erroneous citations.

Fig. 11. Distribution of *Aricia morronensis* in the Iberian Peninsula. Closed circles are citations confirmed by the authors, open circles are bibliographic citations and question marks (?) are erroneous citations.

Our method is far from perfect, because a species present in more than 30 squares that are concentrated in the same area, may be endangered. Major developments such as urbanisation may represent a real threat to the species in this particular case. The reverse may also happen, and a species present in less than 30 squares that is widely distributed, may not in fact be seriously endangered.

A similar problem arises when considering habitat vulnerability, because an "out of danger" species like *Maculinea arion* may become endangered if changes such as those that occurred in England (Thomas, 1980) would ever take place. In the Iberian Peninsula we can say that, based on our own experience high altitude localities are at present less endangered than lowland habitats, where human pressure is more severe. Again this must not be considered absolute, as the situation may change very quickly in certain mountain areas in the future.

Another problem is that of the age of records. Many records are very old, and have not been confirmed recently. Therefore certain butterfly species may have since vanished from some recorded localities. The knowledge in the Iberian Peninsula is still far from that of the British Isles where records can be monitored through time (Heath, 1974).

Table 1. E : endangered, R : rare, O : out of danger,
V : vulnerable, L : endemic, ? : undetermined

	Viedma & al., 1976	Viedma & al., 1985	Heath, 1981	Status	No. UTM squares
Maculinea teleius	R	R	E	—	2 (?)
M. arion	R	R	E	O	124
Iolana iolas	V	E	R	V	33
Cupido lorquinii	V	V	V	V	31
Aricia nicias	R	R	—	E	14
Plebejus pylaon	R	R	V	V	37
Agriades glandon	L	L	—	V	36
Lysandra nivescens	L	O	—	O	101
L. golgus	L	E	V	E	3
L. caelestissima	L	O	—	—	
Agrodiaetus ainsae	R	R	—	—	
A. fabressei	L	O	—	—	
A. ripartii	R	O	—	—	
Aricia morronensis	L	L	—	O	55
Lycaena helle	—	R	V	E	2
Agrodiaetus violetae	—	V	—	—	
Agriades zullichi	—	—	—	E	4
Maculinea alcon	—	—	E	E	23
M. rebeli	—	—	—	E	27
M. nausithous	—	—	E	E	6
Agriades pyrenaicus	—	—	V	E	5
Aricia eumedon	—	—	—	V	36
Tarucus theophrastus	—	—	—	E	12
Strymonidia pruni	—	—	—	E	10
Polyommatus eros	—	—	—	V	34
Strymonidia acaciae	—	—	?	—	
Callophrys avis	—	—	V	—	
Scolitantides orion	—	—	R	—	
Agrodiaetus damon	—	—	?	—	

It may also be possible that some species are under represented on our maps. This may be the case with *Tarucus theophrastus, Maculinea alcon, Cupido lorquinii* and *Iolana iolas*, species for which suitable habitats are more abundant than the recorded distribution of the butterflies.

Limited as it is we think that our method is a useful tool to select rare species. At least it calls our attention towards some species overlooked in other lists due to their abundance in some collections. Our data suggest that species like *T. theophrastus* and *Strymonidia pruni*, together with others included

in previous lists, should be considered endangered, because their limited distribution will make them extremely vulnerable to habitat changes.

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Memoir on the scientific cooperation between Japan and the People's Republic of China for research on Lepidoptera

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Summary

I attempt to identify the reason for the current frustrations felt by the Japanese lepidopterists about their isolation from the Chinese butterfly fauna. It may be due to the absence of an on-going systematic and comprehensive research program comprising many locally oriented concrete projects, which may be proposed for a better understanding of butterfly lives in China, within the existing framework promoting bilateral scientific research cooperation aiming at mutual benefits between the two countries. This does not necessarily mean discovery of new taxa in remote areas where several joint expeditions have so far gone, presumably owing to an awareness on the part of the People's Republic of China of the possible existence of unexplored resources. As an alternative approach, a deeper understanding of the butterfly lifecycle in various ecosystems, especially at the interface between deciduous broadleaf forests and laurel forests in the southern half of China may be thought to be of great significance with respect to the planning of nature conservation compatible with ecology-oriented human development of resources in these areas. A comparison between Japan and China with respect to human-nature interactions would be of particular interest and benefit to both Japan and China.

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Abbreviations

AJCSTE	Association for Japan-China Science and Technology Exchange
AS	Academia Sinica or the Chinese Academy of Science
BIZ	Beijing Institute of Zoology, Academia Sinica
BMNH	British Museum (Natural History), London
COAP	Council of the Old Age Problems
IFTA	Insect Farming and Trading Agency, Bulolo, Papua New Guinea
KAJCSE	Kyoto Association for Japan/China Scientific Exchange
KIZ	Kunming Institute of Zoology, Academia Sinica
KM	Museum Alexander König
LSJ	Lepidopterological Society of Japan
PRC	People's Republic of China

1. Introduction

During 15-24 May 1988 I visited the People's Republic of China (PRC) on an invitation from Academia Sinica (AS) arranged by the Association for Japan-China Science and Technology Exchange (AJCSTE, or Nittyuu Kagaku Gizyutu Kooryuu Kyookai) to meet scientists at the AS Beijing and Kunming Institutes of Zoology (BIZ and KIZ, respectively). This report is the outcome of that visit, including an analysis of the current situation and the results of deliberations on desirable directions for cooperation between the lepidopterists of the two countries in the future. My trip coincided with the widely publicized event (1) in which a butterfly dealer/collector from Japan, stationed in Osaka, was arrested with a fine and deportation in Yunnan Province while poaching (an offence against the provincial laws for protection of natural resources) for the purpose of smuggling out Chinese butterflies, including highly prized species, an operation that involved some local assistants. It also coincided with an uproar by both amateur and professional members of the

editorial committee of *Yadoriga*, the non-specialist magazine published by the Lepidopterological Society of Japan (LSJ), against a proposal of introducing a stringent editorial policy not to accept the parts of a submitted manuscript which described new taxa based on materials apparently exported from the PRC without approval of the authorities there. (The manuscript was unsuitable anyway to that magazine which is not intended for original papers, there being *Tyo to Ga* published by the same society for more formal scientific papers). The board of the LSJ has thus decided to urgently consider whether to announce an official view concerning the policy of the society which will decline to accept for publication manuscripts describing any new taxa based on specimens from China, the export of which has not been authorized by the relevant controlling body operating in PRC, which sets some clear-cut conditions and rules for research and publication on organisms collected in the PRC.

This series of events has prompted me to analyse the current situation about the collecting and export of Lepidoptera in China, as well as research, publishing, and cooperation among scientists from different countries on the subject, in order to determine desirable directions to be taken in the future by the communities of professional and amateur lepidopterists in Japan. This is being done in my own personal capacity, and does not necessarily represent or reflect the official view of LSJ. It is rather meant to serve as a basis for discussion and decisions through an exchange of opinions between the Japanese and Chinese scientists (in a broad sense). I will translate this document into Japanese and will send either or both versions to relevant authorities in the PRC and AJCSTE, and also circulate them among Japanese lepidopterists. Later I may or may not seek their publication, upon appropriate revisions, in *Yadoriga* (in Japanese) and/or *Tyo to Ga* (in English). In so doing, I feel that it would be essential to be frank about the realities in the two countries in order to overcome the obstacles, difficulties and perhaps also any animosities which might develop in certain quarters. In this sense, this document is not meant to be a final verdict but only intended to serve as a starter for further discussion, analysis, and deliberation, and I am willing to withdraw any of my arguments and judgements as premature, mistaken, or misguided if countered and refuted on reasonable evidence or challenged with attractive or persuasive alternatives as advanced by any parties involved.

2. Current void of background knowledge about Chinese Lepidoptera, butterflies in particular

In recent years, the means of international travel and other facilities have expanded the range of collecting trips undertaken by professional as well as amateur collectors of developed countries to various corners of the world. Keeping pace with this, a large number of extensive iconographs in colour of butterflies from various faunistic regions of the world as well as individual countries have been published. This trend now enables lepidopoterists to gain an integral view of butterflies of the world, and, in addition to a host of

classical works (e.g., 2-4), a riot of monographs and taxonomic revisions of various higher taxa has now been published (e.g., 5-13), or can be undertaken, on a world-wide basis. Thus, butterfly faunas of some remote countries such as Papua New Guinea/West Irian of Indonesia (14) and Afghanistan (15), as well as the entire Aethiopian and Neotropical Regions (16, 17), have come to be known fairly well, removing some lacunae in our contemporary knowledge about the butterflies of the world.

Into this picture now comes the present deficiency in the global whole of background knowledge (up to the currently accepted standard) about Chinese butterflies, considered as something regrettable, to be remedied as soon as possible, or even irritating to some. To give an example, I published, on the occasion of describing new taxa of Lycaenini (*sensu lato*) or copper butterflies (Lycaeninae) in Papua New Guinea, a tentative scheme of higher classification for Lycaenini of the world in 1974 (8). At that time I felt that more should be known about some taxa for completion of the study on this tribe. Since then a number of important contributions have been made to studies on some difficult or interesting groups of the tribe : from New Zealand, resurrection of a species hitherto unrecognized (18) and designation of a new genus (19) ; from North America, subdivision of the new-world genera (20) and life history (21) ; and from the USSR, extensive revisions of all the genera, with a few new species, endemic to Central Asia and Caucasus (22, 23).

Meanwhile, after publication of my own paper, I came to notice that a little known but very interesting taxon — *Lycaena irmae* (Bailey, 1932) — had been described from Tibet, a series of specimens being in the British Museum (Natural History), London (BMNH), and the American Museum of Natural History, New York. However, this taxon is not mentioned in the relevant section of the recently published extensive monograph on Tibetan insects (24), a memorable achievement of the Chinese entomologists under the aegis of AS.

In the course of that work on coppers of the world, I stumbled on a certain interesting problem about a correlation between butterfly patterning and lifestyle with its bearings on evolution (8). I have been waiting, albeit in vain, since 1974 for more knowledge on the biological aspects of five species belonging to one particular group of Lycaenini endemic to south-west China including Tibet (see Appendix). These events indicate that the void of knowledge, being gradually reduced for butterflies in many other parts of the world, still largely remains to be filled for Chinese butterflies.

The above story is relevant to the current status of our knowledge on butterflies in the world-wide perspective. I will now specifically consider the state in which Japanese lepidopterists find themselves with respect to their subject — above all, Japanese butterflies and their relationship to allied butterfly taxa from the Asian Continent, especially their ecological, biogeographic, and evolutionary aspects, as well as their significance in the conservation of natural environments and policy for national development. At certain major centres of butterfly collection abroad, there are some substantial materials of Chinese

butterflies, such as the Leech and Oberthür Collections in BMNH, or the Höne Collection in the Museum Alexander König, Bonn (KM). The difficulty involved in referring to the specimens contained in those overseas collections, which must be acutely felt by our Chinese colleagues, and which we know is quite real, is thus also shared by Japanese lepidopterists. Scientists in the PRC can, however, domestically find equivalent specimens, but for Japanese lepidopterists, the export regulations currently imposed on insects by the PRC, appears to be a formidable barrier, indeed almost unsurmountable for some. It might thus be understandable that many Japanese lepidopterists would feel that the current situation particularly and singularly disadvantages Japanese scientists. This is because even though lepidopterists in Japan, Europe, and North America are mainly working on Palaearctic or Holarctic species, the Chinese fauna would not be so directly involved in the work of the American or European lepidopterists, whereas this is not the case with the Japanese, who would then surely find themselves somehow handicapped. A comparable situation for British and U.S. workers would be one in which the import of specimens from the European continent and Mexico is strictly regulated by the governments of those regions. For example, suppose we find that a species, so far assumed to be widely distributed in the eastern part of the Palaearctic region including Japan, actually falls into two or more distinct species — as in the case of a nymphalid taxon *Fabriciana adippe* (Denis & Schiffermueller) and its allies (25). The absence or scarcity in Japan of relevant reference specimens from the continent would make it hard to solve the problem. It would follow that a taxon or taxa native to Japan could not be properly identified without collaboration with competent workers on the continent : a desirable situation but one which may of necessity consume an unreasonably long time.

In fact, such circumstances are felt especially painful and frustrating at a time when Japanese lepidopterists have already explored, fairly exhaustively, their domestic fauna for life histories and other ecological as well as taxonomic aspects, and now wish to solve remaining difficult problems concerning some Japanese taxa by comparison with materials from the Continent, and assisting, if necessary, our overseas colleagues in this respect by applying their expertise to these problems. These points can be verified by the fairly well understood status of butterflies in Taiwan (26), where Japanese workers have so far had relatively good access to the native fauna and have been allowed to freely contribute ; and also by the recent success in the elucidation of life histories of some of the rare, spectacular, and taxonomically crucial papilionid species occurring in Northern India, Bhutan and West Malaysia by Suguru Igarashi (27).

The frustration of the Japanese lepidopterists may thus be summarized like this ; they feel that they are competent enough and more knowledgeable about butterflies in East and South-East Asia at large than any other national groups of the world, and thus would be able to significantly contribute towards elucidating many aspects of Chinese butterflies. Paradoxically, however, they are excluded from contributing in this way by a situation which is the product

of ramified and often regrettable historical processes. This seems now to have led some of the Japanese to the (wrong — I believe, see below) ideas that their Chinese colleagues and the PRC government are virtually throwing away the opportunity to advance and extend our scientific knowledge, a conduct which must be regarded as reactionary and should be resisted by Japanese workers in whatever possible ways : and also that the policy taken by the PRC is based on socialist or totalitarian ideology and would not be valid or generally acceptable in more liberal countries such as Japan.

3. Attitudes of Japanese lepidopterists

The last two decades have witnessed that scientific research cannot claim primacy over other human activities, but should be regarded as only one of many, competing each other for their significance and contributions to human and global ecological welfare. There are areas and subjects in which scientific research must be restricted and/or regulated rather strictly, and many guidelines (28) have been issued, or even laws promulgated, to contain scientific research within reasonable limits to obviate conflicts between it and other human values. These areas now include genetic engineering, human embryology and reproductive science, experimentation on human subjects, and some biomedical and psychological experiments using higher primates.

Regulation of the collection and export of, and the research and publication on, organisms occurring in China as imposed by the PRC, when viewed in this context, looks quite reasonable. Moreover, the PRC is not alone in implementing a policy of this type. Australia has long promulgated a law disallowing export of their insects except under certain conditions, and Papua New Guinea and the Solomon Islands have largely declined issuing permits for collecting in their territories. In these latter cases, the reason for the reluctance to open their countries for overseas collectors seems to be twofold : the undesirable influences of modern personnel on the native community, unilaterally upsetting the economic, cultural and social balances by abruptly introducing a value system which may be valid only in industrially developed countries ; and protection of their natural resources which should be developed for economic activities of the native people as against the *commercial* exploitation by foreign agents. The reason why the Australians erected barriers for free export of their native insects is due to the inconvenience of most of the holotypes of their insect fauna being housed in remote overseas institutions not easily accessible for domestic workers. Some of the Australian entomologists responded with an outcry against the promulgation of such a law, but eventually the law went into effect and has since remained unrepealled, although some of the Australian entomologists are still cynical about it.

It would therefore be quite inappropriate that some Japanese lepidopterists tend to view the barrier erected by the PRC against free access to Chinese insects by overseas workers as a threat to the freedom of scientific research and the advancement of science. In particular, Japanese lepidopterists would

have us believe that, even though they are late-comers with respect to the collection of Chinese materials, the national standard of research on lepidoptera is now quite high in Japan, and indeed much higher than that in the PRC, so that the free access to Chinese materials for Japanese lepidopterists would in the long run contribute more to the sciences and the use of natural resources in the PRC. Such a way of thinking, however, is alarmingly similar to the ideology held in Japan during the twenties and thirties (and which certain quarters of the Japanese wish to resurrect without a body of historical evidence acceptable to the international learned community). Actually, that ideology allowed, on the one hand, the view that the late-coming Japan could help the then "backward" China through Japanese interferences on the Continent, first by a number of dubious self-appointed asiaist activists followed by outright military devastation, and on the other hand led to the failure by the Japanese to help Chinese revolutionaries such as Sun Wen and others who sought asylum in Japan. Moreover, the conditions of international cooperation for research on Chinese insects as spelt out by the authorities in the PRC (29) do not seem to be known, let alone well understood, among most lepidopterists in Japan, who have been baffled in the past by stringent conditions which have reduced the authorized import of Chinese lepidoptera into Japan down to a mere trickle.

As far as I understand from the written material (29) as well as from consultations with our colleagues in both BIZ and KIZ, the conditions imposed by the PRC for the export of insects are as follows : every application for the collection and export of Chinese insects by foreign bodies is judged by the Department of Insect Classification at BIZ on the criterion as to whether such activities are for the mutual benefit of the sciences in both China and the applicants' home countries. In order to satisfy this criterion, any project which involves collecting and research must initially be clearly defined, and an agreement is made that description of new taxa emerging from the project must be written under the joint authorship of both Chinese and overseas scientists. Also, the designated holotypes must be deposited in one of the museums in the PRC, but some paratypes may be retained by institutions abroad. If there are no competent scientists present in the PRC for particular taxonomic groups included in the proposed project, overseas scientists may initially take away the entire series of collected material for study, but for publication the name of a Chinese scientist should still formally be included in the joint authorship. Many laboratories in a number of institutions in the PRC are now open for overseas scientists to visit and stay for research work, and many more will become open in the near future. One of the limiting factors may be the shortage of supporting funds available within the PRC, because housing overseas scientists in any laboratory would require some costs affecting what would otherwise be available for other projects going on in the same laboratory.

Examples in Japan of the cooperative research on Chinese insects in the past and present, conforming to the above conditions, are as follows. Saigusa

& Li (30) on the rare and rediscovered papilionid *Bhutanitis mansfieldi* (Riley) with a description of a new subspecies; Prof. Chikahiko Naito of Kobe University visited north-east Xizang (Tibet) as a member of an AS/Kobe University joint expedition and collected ca. 400 specimens of the Tenthredinidae (Hymenoptera), all of which he brought back to Japan, and recognized some 130 species that are still under study under his direction; Dr Gentaro Imadate of Tokyo has been working on Chinese proturans at the Shanghai Institute of Entomology in collaboration with Prof. Wenying Yun; at the University of Osaka Prefecture, Sakai, Prof. Toshiro Yasuda has been in contact with BIZ on a long-standing basis, exchanging information and insect specimens including microlepidoptera; and quite recently, a joint exploration of the insect fauna in Yunnan Province has been launched under the general leadership of Prof. Toshitaka Hidaka, as a joint project with AS and the Kyoto Association for Japan/China Scientific Exchange (KAJCSE)/ Mountaineering Club of Kyoto University Graduates (Kyoodai Gakusi Sangaku Kai).

This last-mentioned venture is apparently a sequel or the result of some past mountaineering expeditions, which has apparently come to be appreciated as a form of scientific exploration in remote areas of China. A request allegedly came from the Council of Old Age Problems (COAP) of China, some members of which, as meritorious survivors of past revolutionary struggles, seem to be in charge of administering the outback of the PRC, the area which is a very likely and desirable target for scientific expeditions. This apparently seems to be a backdoor or detour, an alternative to the ordinary pathway of filing official applications for joint research projects between Japan and the PRC. I have been told, from both sides of the negotiations, that this application has been a tortuous and difficult process for both parties. For instance, KIZ observed that a direct initial contact with them made by KAJCSE would have made the negotiations much simpler and easier, because it was this institute which was in charge of making the final decision in this kind of matter.

On the side of the Japanese, however, this might not sound as straightforward as is said, because they are aware of the fact that in the past most of such applications have been turned down, and the KAJCSE's initial commitment to COAP might have helped secure the virtually unprecedented breakthrough in the negotiation. Nevertheless, it might simply be the merit of the project which won final approval from KIZ. In relation to the experience of this latest joint venture, many Japanese lepidopterists would feel, on the basis of their past experiences, that what they are told by the Chinese authorities was a willingness to cooperate in general principle, but when it comes to individual projects the responses have simply turned out, almost invariably, to be eventual rejections. However, our colleagues in BIZ might say that they were reluctantly forced to say "No" simply because the proposed project had hardly gone beyond a simple collecting plan without showing any obvious benefit for the PRC.

However, as explained in the preceding section, for Japanese lepidopterists, any concrete project aiming at a deeper understanding of the *known* fauna of butterflies in China (not necessarily aimed at discovery and description of new taxa, and hence not involving designation of types) should require, as the prerequisite, familiarity with, and hence, personal and intimate involvement in general collecting, identifying, and/or observation of, the local fauna (see Appendix). This should be so because research projects would need some good insights into reality, as helped very often by inspirations, which may very well be generated by frequent direct contacts with nature, then and there, involving representative specimens in reasonable quantities (revealing "variations") of the taxa occurring locally.

Another point of frustration felt by the Japanese workers on butterflies is the following: apparently nobody has ever had access to the *core* of the national collection of butterflies allegedly stored in BIZ. The responsible curator of this part of the PRC National Collection seems to have evaded the visitors from Japan having appointments by his simple being away from the institute on appointment days. Various stories based only on guesswork are aired in Japan about this fact, often becoming libellous to the responsible scientist involved. Unfortunately, my own experience does not help in this respect. Owing to some unexpected way of processing, on the side of AS, of their invitation to the PRC extended to me, I happened to arrive at BIZ and KIZ without having directly notified the people at these institutes of the purpose of my visit, and without knowing the dates of my visits until I actually arrived at the respective cities of Beijing and Kunming. I was surprised to find, upon my arrival, that they had not received any information from AS about the purpose of my visit either. To my disappointment, the curators responsible for the butterfly collections were away at both institutes on the days of my visit and I missed the chance to inspect the core of their collections and also the chance to have an in-depth discussion on the subject I describe in the Appendix with the competent specialist in BIZ. In comparison with the museums in Western Europe and the USA which I had visited, however, the butterfly collections of the Chinese institutes seem to be less accessible, even to official visitors. I am therefore not in a position to confirm or to refute some of the rumours going around in Japan that the policy of the PRC for stringent regulation of the export of Chinese butterflies cannot be trusted at face value, but is simply a window-dressing. I can, of course, counter such an argument using a number of positive incidences enumerated above. Future planning for cooperation between Japanese and Chinese workers on butterflies must take into account the circumstances just described, however.

Another relevant point here is that in Japan, research activities on butterflies have been made by very strong initiatives and venturing spirits on the part of amateurs. Their vigour seems to reflect the innovative drives of Japanese corporations and trade companies which have been often overactive abroad, especially in recent years, causing much consternation and antagonism overseas through their overt slant towards the head-on plunge into sheer economic

and cultural imperialism. There is hence no denying that the attitudes of some Japanese butterfly collectors, and also research workers, could have had that stigma of "economic animal", disregarding all other human values in the pursuit of their own set target. However, in entomology, especially with Lepidoptera and Coleoptera, professional specialists in any country cannot afford to completely disregard or antagonize the activities of amateurs because of the mutual benefits in conducting research on many fronts.

In this respect, the representative body of Japanese specialists on butterflies and moths should not automatically be sought among official authorities in the public institutions like university departments and museums, but probably among specialists' associations as exemplified by the LSJ, which however now finds itself in a quandary. This is because overt expressions by some LSJ members of their feelings against the uncooperative stances they think they have perceived among the authorities of PRC, which they think is tantamount to suppressing the progress of science, are now undermining the standing of the LSJ executives who hope to maintain good relationships with all the related bodies overseas for the obvious mutual benefits to be cultivated over a long period of time to come.

4. The current policy of the People's Republic of China for collection of butterflies in China

Written material (29) as well as first hand experience during my visit to the PRC indicates that in the PRC the fauna and flora are regarded as national (and provincial) resources, and that it was mainly the biologists in the PRC who condemned the initial inclination of the government to use rare biological resources for economic gain through export. They apparently did so primarily lest no more specimens of would-be new taxa, including prospective holotypes, should all end up overseas, which would inconvenience and affect classification and identification of economically relevant organisms in China. However, this process may have accentuated their consciousness of the importance of the extremely rich biological resources in China. In conformity to the latest global trend of pursuing rapid economic return from investment for research, the PRC also making various ingeneous uses of the biological resources occurring in China, and more are under intensive investigation and development. This is especially conspicuous with the traditional herb-medicinal materials, but it is also true with animals. In this sense, the butterfly fauna in China may be regarded and protected primarily as resources or possible subjects of economic exploration in the future.

Apparently, the ideas of nature conservation and the management of development compatible with "ecology" have extended the consciousness of the people in the PRC relatively recently, only during the eighties say, despite the euphemistic stories we used to hear of the PRC having allegedly not been spoilt by the capitalist sin of nature exploitation for a short-term profit.

But that was before the advent of the current relaxation of the socialist policies for the benefit of competition-oriented liberal economic activities.

The current Chinese scene is in a way reminiscent of the one I saw around 1980 in Australia, where, as pointed out above, the export (but not general collecting) of domestic insect specimens came to be strictly regulated by the then newly promulgated law. The Australian solution to the problem of "holotype drain" took the form, initially at least, of "holotype declaration" by recipients of exported specimens, usually public bodies, which some museums overseas, such as the BMNH, refused to make, however. In any event, that was meant to be the necessary condition for the granting of a permit of export. The holotype declaration is designed to warrant a return of any holotypes which will be designated by scientists in institutions overseas receiving the exported specimens. However, the Australians were already conscious of their duty to the rest of the world as the "immigrant custodians" of the country's unique fauna and flora, and conservation of nature was on the agenda from the very outset. The Australian biological resources are thus conceived as part of the world heritage, and along with their conservation, the necessity of access to them for appreciation and inspiration, spiritual or scientific, by the world populace at large was in the mind of the Australians, who had undergone a painful soul-searching to make compatible, with any good modern standards, both the domestic and international research activities on Australian insects.

A comparison with the situation in Australia shows that apparently missing in China is an acute consciousness that its insect fauna is also an important part of the world's common heritage as well, especially in its south-west. Histories of the establishment of this fauna would by far surpass the length of the occupancy by the Han people of the area in which the fauna exists. However, their history in its turn has been as long as that of any human society, and their settlement in mainland China has never been interrupted, even though the course of Chinese history has not been uneventful as to the rise and fall of various dynasties belonging to different ethnic groups. Moreover, we are aware that in the recent past, the Chinese people have been brutally alienated from their resources under an imperialist devastation of which Japan regrettably played the worst part. It is therefore quite understandable that in the consciousness of the Chinese people, biological resources in China would unquestionably fall in their proud and just hands quite naturally. However, foreigners might imagine that they were having a touch of traditional sinocentrism in this form of thinking. In any event, the flora and fauna of China are inseparable from the rest of the world, and the world scientific community should respect the fact that they are under the trusteeship of the Chinese scientists. What is missing here is, therefore, certain positive statements coming out of the PRC as to their provisional plan for the course of feasible investigations to be made internationally on their unique biological existences. In its absence, any positive proposals on the subject to be submitted by outsiders may occupy the mind of the

international body of specialists, superseding or even making obsolete, by dint of the inherent attractiveness of the subject, the national claim to it by the PRC scientists and the government alike. The only plausible plans which have so far been visible were joint expeditions to remote areas in China, which may collect information on the occurrence of so far unexplored national resources and hence welcome to the nation-state.

A further comment on the policy for national dependence on natural resources may be pertinent. Brazil, Mexico, Argentina, and more recently, Australia have shown the danger of depending too heavily on their very rich natural resources for international economic gain, because these countries are now grappling with stimulating their economies in the absence of powerful secondary or tertiary industries. Dependence on primary industries, however rich the extant resources may be, has finally proved to be quite precarious. Meanwhile, the continuous Japanese success in the world economy during the past several decades has been noted in good contrast to (or exactly in association with) the almost total absence of natural resources (except water and diligent people which at least the southern half of the PRC shares with Japan — Guangzhou's economic success may be quite relevant here !). Likewise, the recent economic rise of what are generally called NIES (Newly Industrialized East-Asian States) — those smallish nations and communities like South Korea, Taiwan, Hongkong and Singapore — are all virtually without resources, so that economic prowess without resources now seems to be the rule rather than the exception.

Of course, at the beginning of its modernization, Japan had to rely heavily on practically sole natural resources — silk, which is of course completely obsolete now. It is also a lamentable fact that the atrocious Japanese invasion into China or the Asian Continent at large was motivated by the fear of its non-possession of natural resources that appeared to be essential to the survival of a nation, a myth which has since been spectacularly broken by a few Asian nations including Japan itself.

Of course, the situation surrounding the PRC may have factors of a different nature. It is saddled with a huge population, enormous space to defend, and the existence of quite a number of ethnic minorities. It has brilliantly succeeded in feeding its immense number of people rather well — meat now seems to be part of their staple food (allegedly at the expense of some endangered species ? — see ref. 46). Their economy is now conspicuously rising, its annual GNP increment being close to those of the highly successful NIES countries, probably thanks to the recent change in the policy of the PRC government even if with a price to pay. The rise of a middle class, if I am allowed to use such a capitalist expression, may be almost imminent in the PRC. Soon, I expect, there will be a cohort of competent amateur lepidopterists in the PRC, who will, if guided properly, contribute enormously towards entomology in China. I understand that there is already a private association of some 200 lepidopterists in China, based in Shanghai. Also there seems to be a privately owned butterfly museum in the same city (31). It is probably time

to define, and to design a future path for, the desirable relationship between amateurs and specialists in lepidoptera studies within the PRC, as well as that between amateurs in the PRC and abroad.

Even though it could not be admitted officially in the PRC as once was true of its relation to Taiwan, indeed there has been an extensive poaching and smuggling of butterflies in China since around 1980, undertaken not only out of commercial drive, but perhaps primarily from the love of or longing for the butterfly fauna in China. This is not limited to Japan but shared by some of the European countries, which all belong to the same Palaearctic Region faunistically. In the absence of a major drive towards understanding or further research on the Chinese butterfly fauna coming out of the PRC (which is understandable given the political and economic troubles PRC was in), the existing void has been partly filled by the scientific fruits of such illegal conduct. Like some Russian artists and scientists in exile who have been accepted without question in Western countries, not only smuggled specimens but also relatively large bodies of novel scientific data recently obtained privately about Chinese butterflies have now started infiltrating lepidopterist communities outside China and being publicized only partially (32, 33), in Japan at least, and it is now becoming impossible to talk about aspects of Palaearctic butterflies without these data (47). Are we to regard them as a necessary evil produced by the course of historical contingencies, just like our current appreciation and utilization of the scientific and technological achievements for which war-time research work conducted with the objective of destroying the people of other nations was largely responsible ? With good and adequate planning to-day, the seeds of future evils may be eliminated — possibly. But what to do now with the products of past evil ? Should Australians all exit their island continent in the south leaving the country to the Aboriginals' autonomy ? Or should even the latter, who are now known to have driven a majority of marsupial fauna there to extinction, also desert the country for its original non-human occupation ? Should Euramericans evacuate the new world leaving behind Amerindians alone ? Is what we are trying to do now not to remedy as much as possible the damages perpetrated by the past mistakes of our ancestors, and to work, as equitably as possible, for the welfare of the surviving people, an enormous struggle as it may be ?

Before concluding this section, I would like to point out that local natural resources have multiple potential uses, with possible conflicts between different modes of their utilization. In particular, the contradiction between development and conservation should be carefully assessed for their short- and long-term effects. In this sense, butterfly resources, to be considered further below (section 6, p. 72) as useful indicators of local ecosystems, may always be in danger of eradication through various types of local development for a quick economic return. Therefore, we need to be constantly vigilant of butterfly resource, as convenient warning indicators of environmental deterioration. We need to monitor the soundness of butterfly resources by a cohort of competent collectors, who would quickly sense the vulnerability of the ecosystem under

current courses of development. A group of Japanese observers (32), using year-to-year variation of the local butterfly population at a locality in the PRC, has recently been led to infer extinction of a rare local butterfly, *Bhutanitis mansfieldi mansfieldi* (RILEY), and has correlated it with an almost total destruction of primary forests in the relevant habitat within the autonomous region of a minority at South Lijiang, North Yunnan. In this sense, it would not be simply declaring the possession of a local biological resource and prohibiting its collection, but rather the effective monitoring through continued collections (allowing an exact identification) which will give the best information about the status of that resource. In the case of biological resources, one has to take into account their dynamic nature, and should not easily apply the criteria effective for non-animate resources which do not proliferate.

5. Policy for publication in Japan on Chinese materials

The poaching and smuggling of Chinese lepidoptera are by no means a monopoly of the Japanese, but the attitude of the Japanese lepidopterists seems to be more aggressive than the other nationals. Usually secret collectors overseas seem to be content with having had first-hand experience with (particularly live) insects in China, getting familiar with the biotopes in which individual species thrive. However, they seem to be aware of the danger incurred by publishing papers based on the material with dates which would immediately expose the fact that the specimens used must have been collected without authorization. This will smear the good name of the writer, from which one would usually shy away. However, there have been open publications, in Japan, of some new taxa described from obviously smuggled material which may or may not be associated with commercial activities (33). The holotypes of the taxa thus designated have not been deposited in any public institutions, let alone Chinese ones, which is in the first place not in accord with the recommendation of the International Code of Zoological Nomenclature, not to speak of the policy of the PRC. Such privatization of holotypes may sound like a horror story in the English-speaking countries, where national collections are well centralized in a few authoritative museums. However, in Japan as well as in West Germany, there are many smallish local museums and apparently no single centralized authority has a national collection for reference, which may seem to give individual workers second thoughts about depositing holotypes in public institutions. In fact, the strong activities of non-governmental institutions in Japan are now well known as some of the main contributors to Japan's recent economic success.

In this connection, the achievements of Prof. Siuiti MURAYAMA of Aichi Gakuin University near Nagoya would deserve a special mention. He has been long committed to Palaearctic butterflies and has had good personal contacts with lepidopterists in China even since the time preceding the liberation in 1949, and has from time to time contributed towards knowledge

of Chinese butterflies, so much so that in recent years his help and advice are being sought by a few Chinese lepidopterists working in several local institutions. In recent years he has contributed, however, a few papers containing quite a few new taxa from various localities in China, based on specimens of unknown status (with respect to export) collected during 1980 and 1982, to a taxonomic journal published in the PRC (34). Moreover, he published these papers alone, i.e. not jointly with colleagues in the PRC, and all the type specimens including all the holotypes are apparently kept in his possession. i.e. not deposited in a public museum in the PRC. It is all the more surprising that these papers by MURAYAMA were accepted and printed in an academic journal published in the PRC. Hence it might be argued that, despite the policy insisted on throughout our formal negotiations, the rule has not been stringently implemented in practice even in the PRC. The arbitrariness involved may very well be used for justifying publication on unauthorized material elsewhere, and would threaten to nullify the signicance of my effort in writing this memoir, trying to work out a desirable course for LSJ to publish articles on Chinese materials. Moreover, as MURAYAMA himself told me, his papers have often become subject to intensive criticism in Japan. Although it is true that MURAYAMA is one of the most knowledgeable lepidopterists of Chinese and Palaearctic butterflies in Japan, uncritical acceptance of MURAYAMA alone by lepidopterists in the PRC may pave the way for academic criticism directed at taxonomic works done in the PRC by Japanese colleagues. It would be a pity for science if the current situation in the PRC would lead to more alienation toward the best Japanese lepidopterists.

In any event, the aggressive attitudes by some would encourage others to behave likewise, because obviously there is motivation for competition in Japan. If left uncontained and unreserved, this trend would infect many other workers, and the entire nation may eventually be regarded as perpetrators of illegal activities (in the PRC) because they failed to respect the policy of a friendly nation.

The most straightforward policy to be taken under these circumstances by a responsible association of lepidopterists in Japan such as LSJ would be to refrain from publishing any accounts containing references to Chinese materials with no evidence for their authorized export from China. However, such an attitude will reduce the popularity of the association and its publications among Japanese lepidopterists, thus undermining the association's sound economic basis, and consequently leading to a decline of orthodox scientific activities. It would be easier for a purely professional association of entomologists to implement a stringent editing policy in this respect. The Entomological Society of Japan defined, in 1982, their policy about new taxa described on the basis of specimens from the PRC etc. thus : the authors describing new species-group taxa should settle the question of depositing the type specimens with responsible people of the country from which the specimens originate.

A compromise may be effected by a policy according to which, upon receiving manuscripts containing descriptions of new taxa based upon unauthorized Chinese materials, a consultation is held with the authority at BIZ as to whether the manuscript may be published if the author(s) could be persuaded to revise it in such a way that as to meet the set criterion for bilateral collaboration in entomology : inclusion of at least one Chinese author and desposition of the holotypes and appropriate numbers (usually around 50%) of the paratypes in museums in the PRC. In fact, such a rule of handling has already had a precedent (30) for a series of specimens the collection of which actually violated either the provincial laws or the authorized principle of collecting by foreigners (29). It would indeed be a pity to suppress any publication resulting from it if a rare or unusual material stemming from smuggled material turned up in the laboratories of some researchers, and proved to be of obviously high scientific value. This is because, even if rejected here, the paper would only find its way to publication somewhere else, a matter for which no overt social punishment would be made. It would thus serve well the purpose of the Chinese scientific community to have half of the material including the holotypes returned to China. However, it would certainly be a dilemma for the authority in the PRC to go happily all the way with this policy, because that is tantamount to a *de facto* authorization of smuggling, certainly a contradiction of the good intention of erecting the export barrier. Judgement might therefore be made only on case-by-case basis.

Suppose that the PRC authorities are agreeable to this policy in principle, even if they handle the case negatively for the most part. There might then sometimes be articles on the material from China but originating from a time when the official export barrier had not been erected yet. I means that one might work on material out of the Höne collection say, and name new taxa, of which a classical example is not unknown (35). Certainly such a paper can be published freely without violating the rules set by the PRC. However, it would always be a gesture of goodwill to notify the Chinese of the existence of such a manuscript, generating a chance that the PRC could receive some of the types returned. What would happen if the new taxa were based on a single holotype ? The argument may then be raised that it would be premature to describe a new taxon ; and that it would not conform to the good usage of publishing a new taxon based on a single holotype, although this has been done often by some Chinese authors (36). The procedure may encourage a joint effort to secure more material by international cooperation.

In this connection I should like to point out that a rumour is going around in Japan that in the PRC taxonomists are encouraged to name new taxa because they would be rewarded on a per-taxon basis. This point needs to be clarified in order for us to launch any collaborative work, because we have to understand how things are done so that we can adjust our attitude, within a certain limit of course, towards naming new taxa in collaboration with out Chinese colleagues, simply in consideration of making academic life easier for them whether or not we would approve that type of policy for the long-term soundness of taxonomy.

To summarize, then, there would be three alternatives for us to recommend as an official policy for a publishing body in Japan.

1) To decline publishing any accounts dealing with the designation of new taxa on the basis of material exported from China without authorization.

2) To negotiate with authorities in the PRC whether or not they would agree to such publications as given in 1), provided the author(s) could be persuaded to meet the currently set conditions regarding the authorship and the deposition of type materials.

3) To follow the same format as in 2) for all the accounts involving materials originating from China regardless of the time of their collection and export, but to leave the matter to the discretion of the author(s) if they are not immediately agreeable to such a procedure. The author's decision would include their insistence on the submission of the paper, the acceptance of which should then be judged only on its scientific merit.

6. Butterfly studies as the basis of understanding interactions between human society and nature, and of conservation of nature

Consciousness of the necessity of nature conservation in industralized countries has often resulted in banning butterfly collections, but it is already apparent that such actions are in most cases making collecting activity a scapegoat (37), in order to divert the attention of the people from the real cause of environmental disruption due to development with little concern for nature conservation. Rather, butterfly collecting with restraints and careful scientific observations by a body of keen amateurs has proved to function as a sensitive detector of the first sign of environmental deterioration. This is because butterfly fauna may serve as an indicator of ecosystem integrity for about 80% of the latter's diverse members (38).

Owing to its species diversity and beauty, the whole butterfly group (Papilionoidea and Hesperioidea) may readily become the subject of attention even for those who have not had professional training in biology. Exactly this property of butterflies renders them capable of mediating our cognition of various terrestrial ecosystems even including littoral ones. The reproductive mechanisms of most insects, including butterflies, are radically different from those of higher animals. Only a very small fraction of the offspring can usually survive until reproductively mature adulthood, so that collecting with restraint or the breeding or rearing of butterflies does not significantly affect their natural population. It is usually the destruction or modification of habitats which leads to eradication of individual, sometimes even unique, colonies of butterfly species.

Interest in butterflies taken by a small fraction of the population will help clarify diverse aspects of their lives including the mostly herbivorous, but sometimes also the carnivorous early stages. Information about the way each butterfly species depends on local flora (and also some part of the fauna)

may be used effectively to deduce the cause of a decline of butterfly fauna in a given area, which in turn is an adequate indicator of environmental deterioration of one sort or another.

Moreover, Hiroshi MORIYAMA (39) has succeeded in his recent work in delving deeper into the reality of human-nature interaction, using, as a tool, aspects of butterfly distribution, reproduction, and local extinction. MORIYAMA argues as follows : It is generally believed that the south-west half of the prehistoric Japan was once (around 2000 BC) covered by laurel forests comprising laurels, camelias, evergreen *Quercus* species, etc. This was because the laurel forest was able to gradually advance to the north-east following the end of the last ice age about 12,000 years ago and after the general warming up of the Japanese Archipelago 7,000 years ago. However, the laurel forest was almost totally destroyed, in the plains in particular, on its way to the north-east by the prehistoric/historic agri-/silvicultural practices in the Japanese islands, except for their southernmost aspects, over a period of several millennia, with its tiny remnants surviving like sacred symbols within the enclosures of old shrines and temples. The inhabitants of the islands opened up the forest cover by field burning, and the area thus opened allowed the regeneration of the deciduous broadleaf forests then on their retreat to the north-east, either by artificial planting or as a part of natural succession. Such deciduous forests in the laurel forest zone contributed, according to MORIYAMA (39), to the recycling of natural resources by the inhabitants, and hence would have been actively maintained by them. At the same time, the initial patches of the deciduous forests provided a variety of ecological habitats comprising such man-made deciduous forests at the interface between human habitation and nature as well as between laurel forests and deciduous forests. MORIYAMA estimates the rate of dispersal of individual plant species by taking into account the behaviours of various animals that helped to disperse the seeds of the plants, a calculation which altogether indicates that with some plants the dispersal must have been extremely slow. MORIYAMA thus concludes that the contemporary flora of the deciduous forest zones, with their characteristic butterfly faunas, could not have emigrated all the way from the north-east long after the preliminary establishment of a homogenous laurel forest, at the time when this came to be extensively opened later by intensive human activities and gave away to the invasion, if temporary, of quickly growing deciduous forests. Rather, he suggests that such deciduous flora and its accompanying fauna, would represent the local ecosystem which managed to survive, thanks to the human interventions, there at the time when it was being encroached upon for the first time by the advancing laurel forest.

Now MORIYAMA notes, along with others, that natural environments of south-western Japan are now once again changing into laurel forest, which in fact represents the natural (or climax) vegetation conforming to the climatic conditions of the area. This change is prompted, as is widely acknowledged, by the recent change in the mode of agricultural production. The advent of modern, mechanized, energy-intensive (petroleum/electricity) agriculture has

changed the pattern of rural life in Japan : many processes involved in the traditional agriculture both on rice fields and around nearby copswoods, yielding harvests which mediated the quite effective recycling of elements through soil and water circulation, are now being abandoned and replaced by the technological products such as pesticides, herbicides, fertilizers, plastic hothouse and indoor cultivation, etc. MORIYAMA identifies several species of butterflies as indicators of such a traditional ecosystem undergoing human interferences, although the ecosystems comprising deciduous forests have hitherto been generally regarded as wilderness. In reality, such interferences are integral parts of the local culture of human society.

Nowadays, both butterfly species and traditional human culture are vanishing hand in hand with the local mixed vegetation of copswoods. MORIYAMA mentions that larvae of some species of thecline genera (Lycaenidae) of butterflies feed on the young growth of *Quercus*-species, which used to be planted in rural areas or constantly rejuvenated through rotational felling of the copswood for charcoal production, but that they have now long vanished from overgrown "conserved" areas, where once they were well established. Apparently a similar situation has also occurred at one of the reserves in southern England (37). For another example, *Luehdorfia japonica* LEECH (a popular papilionid species endemic to Japan) depends on blooming plants in deciduous forests required for feeding of the adults in the early spring and on plants (*Aristolochia* species), confined in laurel forests, which are essential for larval food ; therefore *L. japonica* can thrive only along the interface of the two kinds of forest, once quite prolific in Japan, and hence intimately bound to traditional human settlements in south-western Japan.

Thus, MORIYAMA's work has posed the question as to the real meaning of nature conservation. In such areas as Japan (and also China) where human communities have flourished long without major disruption or catastrophe, the concept of nature should mean ecosystems integrating human activities, and any policy for nature conservation must take this point well into account.

This conclusion reached by MORIYAMA with respect to the Japanese scene finds its parallels in other parts of the world, indicating its rather universal validity. I wish to mention two examples : First, in England, the endangered butterfly species *Maculinea arion* (LINNAEUS) (Lycaenidae) became finally extinct only very recently, because, in an attempt to keep their remaining unique habitat as undisturbed as possible, conservationists removed the local herds of sheep which had been there all the time. The sheep, however, were apparently an indispensable part of the local ecosystem supporting the life of this butterfly, the grazing sheep (or numerous rabbits) keeping the sward of turf very short, a condition that was needed for a particular kind of ant which was an essential factor of this myrmecophilous butterfly's complicated lifecycle (37). Some other endangered butterflies species are known to require similar short turf (37). Secondly, in the highlands of Papua New Guinea, around 2500-3000 m, I found some new taxa (8) of Lycaeninae (*Melanolycaena* spp.), which were quite remarkable for their occurrence in that country in

relation to the global distribution of their allies. In all likelihood they fed on a polygonacean creeper that grew well in the areas where forests had once been burnt by local people for highland agriculture of sweet potatoes, but which had turned into secondary forests after being abandoned for a long-term recycling land use. These incidences also suggest that stopping of traditional human activities would simplify the natural habitat and would lead to eradication of some of the local ecosystems.

7. Suggestions concerning projects for future cooperation in scientific research

As explained above, butterflies now occupy an exceptional position among insects for the following reasons. Their group is fairly large, nearly 1,200 or eventually more species may occur in China alone (40). This warrants that they are diversified enough to occupy very divergent niches, so that they could be used as markers of general terrestrial ecosystems. Moreover, butterflies are conspicuous and often very beautiful creatures, and most of the existing taxa are already named and classified to a reasonable degree. They thus may easily serve as the subject of amateur interests. For insects in general, the main task of entomologists in the PRC would be to catalogue the vast number of taxa native to China, though with butterflies that stage must now be over. It is time to go deeper into their biology; in the PRC as well as in any other countries of the world.

Given this fact, it would now be imperative to devise a large number of attractive research projects to be jointly undertaken by lepidopterists of the two countries in order to effectively suppress, supersede, or at least compete with the lure of new scientific information based upon unauthorized material from China, and instead to obtain the consent of competent lepidopterists in Japan for fruitful research cooperation on the butterflies of China with research workers of the PRC, including amateurs. Here I wish to suggest a few candidates for such projects.

A. *Sale of a set of Chinese butterfly specimens to a museum in Japan*

As a drain of holotypes to foreign countries from China makes identification of Chinese insects difficult for entomologists in the PRC, the absence from Japan of systematic representative collections of Chinese butterflies makes it likewise difficult for Japanese lepidopterists to gain deeper insights into taxonomy and hence higher degrees of sophistication in identifying Japanese butterflies. In order to remedy this fact, a reasonably good set of representative specimens of Chinese butterflies (5 specimens of each taxa say) may be sold to a responsible Japanese museum, which should be willing to sign a contract guaranteeing a permanent curatorship of this collection and the eventual return of holotypes as well as the coauthorship with Chinese scientists for publications materializing therefrom.

Relatively small as it may be, this will represent an economic gain for research work in the PRC.

B. *The possibility of commercial butterfly farms in China*

Since demands of Chinese butterflies exist in the world market of Lepidoptera specimens for aesthetic as well as reference materials, some forms of butterfly industry may be set up in the PRC. In some habitats, the intensive collection of adult butterfly specimens would not endanger the local population, as has amply been demonstrated in Taiwan. However, for some species, it would be wise to breed or rear butterflies from eggs to be obtained from natural or artificial pairings. Such activities have been envisaged in Papua New Guinea, not only for the endangered birdwing butterfly, *Ornithoptera alexandrae* ROTHSCHILD (only after firmly establishing the protective measures for its survival in the field), but also for other commoner species with which the method has proven to be practicable (41). For the latter taxa, in addition to many others, the Insect Farming and Trading Agency (IFTA, see ref. 42), has been established for some time in Bulolo by the government of Papua New Guinea. Rearing butterflies *ex ova* will save a large number of individuals which would otherwise perish without surviving to adulthood, and which eventually would be employed as mounted specimens. It does make compatible both the provision of specimens for commercial purposes and the protection of the natural population, and would thus help local economy based on the native resource at hand. With some extra paperwork, setting aside a few reference specimens for adults emerging from each clutch, and labels inviting the return of the specimens or enquiries about more reference specimens in the event that new taxa are named using the specimens thus labelled — probably with some reward and a proposal of a joint authorship — the possible holotype drain (if any) through this channel would be considerably reduced. Japanese lepidopterists would be able to assist the Chinese personnel with a business with highly sophisticated techniques of breeding and preparing immaculate specimens of high commercial value. Both sales of specimens of good value and dealing in commoner specimens *en masse* for ornamental purposes may be considered.

C. *Publication of illustrated books in colour*

Given the current relative scarcity of information about Chinese butterflies, publication of a book or books on Chinese butterflies would serve as a stimulant to the populace which will support some good numbers of amateur lepidopterists. Such books should simply be regarded as a stimulant for, or a starter of, intensive research works rather than as the culmination of a long, dedicated scholarly or academic life. Hence duplication of books written by different authors on the same subject need not be avoided.

It is a common experience for many countries that a relatively inexpensive, colour book on the national butterflies would boost sudden enthusiasm among large number of amateur collectors and would interest some more dedicated entomologists, whose activities would then produce, for the first time, a solid body of really useful and important information about the subject. Such books are badly needed for Chinese butterflies.

a. On Chinese butterflies

This may be planned at various levels of academic sophistication, but should mainly be planned and written by our Chinese colleagues, with the role of Japanese workers perhaps being consultation and providing the skill for colour reproduction with relatively low costs. Some of the editions should be of small size with reduced-size illustrations in colour but without necessarily reducing the quality of the text. Such books with lower prices would be needed to ensure good circulation among amateurs in the PRC. The field-guide for the Japanese butterflies by HIDAKA *et al.* (43) might offer a good model.

b. On the butterflies of the East Asian Continent and some ancillary islands

Except for the Japanese islands and Taiwan, the butterflies of which have already been the subject of a number of excellent books, a rather ambitious, extensive book on East Asian butterflies is badly needed. This will include the Soviet Far East and Korean Peninsula as well as China, probably omitting Central Asian Elements. Such a book should be published with texts in several languages, and would enable lepidopterists of different countries to view their domestic faunas against a general background. Materials for illustration may be sought among collections from all corners of the world, including the good collections housed in the BMNH and KM and numerous private collections in Japan and Europe.

Incidentally, I recently took part in a bilateral consultation with the Russian scientists working at the institutions of the Far East Branch of the USSR Academy of Sciences, on the possible means of collaboration in biological research on the resources in the Far East. This was quite successful, primarily in the sense that both sides found very coingenial partners sharing the same enthusiasm about their subjects. We witnessed, with fascination, that the Russians first presented a very relevant, attractive, and comprehensive research program on the evolution of the biosphere in the Far East, and that they are now consciously very flexible in implementing the collaborative research programs. I was also pleased to find that they all highly appreciated the earlier text of this memoir and give their approval of the framework in which I tried to put the research programs with the PRC. It was also envisaged then that we would eventually expand the scope of this collaborative research to embrace Chinese and Korean scientists and their biological resources.

The book will need a tremendous amount of work, but we shall have to be satisfied with a rather modest achievement at the beginning, mainly trying to induce an improvement and completion of the work in the future. Input from our Chinese colleagues would of course be welcome and would surely be very helpful.

D. *Elucidation of life histories of practically all the species of butterflies occurring in China*

This might sound as too gradiloquent a project. However, we should recall the fact that Dr Susumu IGARASHI, who has been concentrating, out of his

personal funds, on rearing *Teinopalpus imperialis* and other extraordinary papilionids in Asia, has been able to clarify, as a by-product of his long search over 25 years, life histories (hitherto unknown), of 300 Southeast Asian butterfly species in addition to his success in the target group of the Papilionidae (27). If a large number of enthusiastic and competent Japanese lepidopterists were allowed to work in China in collaboration with some newly rising entomologists in the PRC, the project might help spread sophisticated techniques for life history studies possessed by the Japanese lepidopterists, which would exert two obvious beneficial effects on the PRC. The project would contribute towards educating and training a large number of potentially competent young people for looking into the ecological aspects of insects, and it would also elucidate various ecological problems associated with the ecosystems endemic to China. This project must be based on the progress of projects A-C, and obviously serve as the basic studies for project E. Fortunately, the first step along this line has been made recently as a part of the research cooperation between Japan and PRC, a very welcome event indeed.

There is already some body of information in Japan on the life histories of Chinese butterflies (32) indicating that efforts have recently been made, with some success, in elucidating many so far unknown life histories of butterflies in the PRC.

During the course of the project, some video recordings would be made by the mass media from either country, and these would be used for educational and entertainment programs to be released all over the world. Publication of several volumes in colour of the early stages of Chinese butterflies should follow.

E. *Studies on human-nature interactions at the interface between the deciduous and laurel forsts in the southern half of China, using life-cycles of butterflies as effective indicators*

This is the logical extension of the studies made by Moriyama (39) for Japanese ecosystems and butterfly faunas, which I described above (pp. 73-74). In Japan, the origin of the Japanese fauna and flora as well as agriculture and social institutions (i.e., general human cultures) are usually assumed to be intimately associated with the laurel forest zone, and these institutions may have originated in south-west China (Yunnan, in particular) (44). Originally, it was believed that the human culture further south in the tropical forests had given rise to the cultures in the laurel forest zone, which extends from north-east India eastwards across the Southern part of the Asian Continent, including the southern half of China, then extending to Taiwan, the western half of Japan and the southern tip of the Korean peninsula (44). The general theory then changed to assume (45), rather that the culture of the laurel forest zone was of primary importance, giving rise southwards to the cultures in the tropics and interacting with the latter. Now Moriyama (39) has drawn

our attention to the interface between the laurel forest and its neighbouring zones to the north and higher above, the deciduous broadleaf forest.

This is rather a new insight, and a lot of things may be learned by this novel approach about the origin of postglacial agricultural exploration in the temperate climatic zone in Eastern Asia and its interaction with the local vegetation.

We generally believe that the vegetation of vast areas of China has been largely destroyed (sometimes, to the extinction of some rare butterfly taxa — ref. 32), artificially modified, and exploited throughout its very long history, except for a few sanctuaries. It would be important to prevent further environmental deterioration and protect the integral human/nature complexes with their highly characteristic ecosystems in most parts of China, its southern half and south-western part such as Yunnan in particular. We believe that information about butterfly life in these areas would greatly contribute to our understanding of such a cardinal aspect of nature conservation and social development. This will be a multidisciplinary project including agricultural sciences, history, archaeology, cultural anthropology, ethnology, climatology, and palaeontology, as well as botany and biology in both countries, but preliminary elucidation of butterfly life histories may be prevented by their diversity and the scarcity of competent professionals. Hence there is a particular significance and importance in the intimate collaboration of professional scientists and amateurs in the two countries.

8. Acknowledgements

I am, of course, very much indebted to our colleagues in the PRC for giving me some first-hand ideas about the possibilities of launching cooperative research on Chinese butterflies between Japanese and Chinese specialists. Many colleagues in Japan also gave me their opinions and a large amount of material for deliberation. In order to make it clear that all the opinions expressed here are mine, and that I am solely responsibly to them, I refrain from giving individual names of those esteemed colleagues of mine, only expressing herewith my hearty thanks to their assistance and goodwill. However, I wish to thank Prof. Ryukichi Hashiguchi, the President of the Association of Japan/China Scientific and Technological Exchange, and the Chinese Academy of Sciences for enabling me to make a trip to the PRC, and Mr Rick Davies for his painstaking linguistic corrections of the text.

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Appendix

In China, besides the ordinary copper butterflies including *Lycaena standfussi* (Grum-Grushmailo) (Lycaenidae, s. lato : Lycaeninae, s. lato : Lycaenini, s. lato including the subtribes Lycaeniti or coppers of ordinary appearance and Heliopholiti), there occurs a group of five rather unusual-looking species

belonging to Lycaeniti endemic to the South-west of China : *Lycaena ouang* (Oberthür), *L. li* (Oberthür), *L. tseng* (Oberthür), *L. pang* (Oberthür) and *L. irmae* (Bailey). They might eventually prove to represent a good genus of their own (Group of Five), showing among them a very interesting transition from a hairstreak-type wing shape and patterning (*ouang* and *li*) to those of the ordinary copper-type (*irmae*). I found that the subtribes Lycaeniti and Heliophoriti which were distinguished by some solid morphological differences, also differed from each other largely in their external look : the thecline or hairstreak-type appearance predominated only in Heliophoriti (8). I therefore wondered whether the two species *ouang* and *li* in West China would behave like thecline species, living among or on trees and shrubs rather than in meadows and other open spaces. I also wished to ascertain foodplants of all the five species mentioned above, to find out the extent of "adaptive radiation" in this compact group of Lycaenidae, as well as to examine whether the accepted differences between Lycaeniti and Heliophoriti were also actually due to the adaptive or functional rather than structural differences. Needless to say, this point is of some importance in assessing the meaning and nature of individual characters used in the taxonomy of this group, which might possibly demand a reappraisal of the taxonomic methodology currently used for this group.

Note added in press

S. Koiwaya, in *Yadoriga* (141), 13-22 (1990), has recently pointed out that, although foreign travellers, scientists or otherwise, are not allowed to catch and take away (export) any butterflies of China without permission of the Academia Sinica, Chinese citizens may freely collect and sell them as a part of foreign trade. Butterfly materials thus obtained by foreign collectors and scientists could be used without the restrictions which would be imposed on them if they themselves collected those insects. I mistakenly interpreted that such trades by Chinese subjects were also illegal, thus stating that descriptions of the new taxa by some Japanese authors in reference 33, published without disclosing the route by which specimens of the new taxa were obtained, must have been based on poached (by whomever) materials. Apparently this need not be so. According to what Koiwaya has elucidated, probably 99% of the butterfly specimens from China now in the possession of Japanese collectors and dealers were exported to Japan quite legally, with the assistance of many, presumably trained Chinese collaborators for economic gain. The question arises, then, as to why Chinese scientists at the Institutes of Academia Sinica have not mentioned these points to Japanese scientists, not least because new taxa from China based on such legally exported materials may be named, with neither the holotypes returned to Chinese public institutions nor Chinese scientists being invited to joint-authorship.

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